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CONTENTS

Dynamic Simulation Analysis of A New Type of Mid-low Speed Maglev Train Secondary Suspension

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Abstract: A new type of mid-low speed maglev train was the research object in this paper, the new structure of suspension module was introduced, and discussed the principle of self-steering. The topology diagram was made after analyzed the kinematic relations between the main components of the maglev train, the dynamic simulation model was established by using the multi-body dynamic software SIMPACK, and simulated the dynamic response of secondary suspension while the maglev train in extreme working conditions. Simulation results show that the extreme horizontal displacement of air spring is less than 5.4 mm while the running speed is 140 km/h, and when negotiating curve of 50 m radius, the maximum horizontal displacement of air spring is no more than 13.5 mm, both in allowed range.
Keywords: mid-low speed maglev train, dynamic, secondary suspension, simulation

1. RESEARCH BACKGROUND

In the research into the dynamics of maglev train, many experts and scholars have made brilliant contributions: German experts Gottzein and British scholar Sinha first began to study of maglev train control technology[1-2], Gottzein once combined theory with experiment to research Germany MBB and TR maglev suspension control, and compared the vehicle-track system dynamic stability and anti-interference ability of the control system while the maglev train used electromagnet centralized control and decentralized independent control two different ways. Sinha discussed the track irregularity of turbulence effect on the stability of the maglev train suspension system, and made a series of analysis[3]. German scholar Popp on the basis of predecessors' research considered the state feedback control system, and established the track dynamic model[4]. American Cai did a lot of research on vehicle-bridge interaction[5]. Japanese Hosoda simulated the HSST-03 throughout 250m radius curve and did actual measurement[6]. Chinese Wan-ming Zhai and Chun-fa Zhao research team from the perspect of system dynamics to study the maglev train suspension system dynamic characteristics, random vibration and stability[7-10].Besides, there are a lot of experts and scholars did research on maglev train dynamics, suspension frame analysis and curve negotiation[10-14].

Based on those dynamic theories and methods of maglev train, the dynamic simulation model was established in this paper, and calculated the displacement of air spring while the maglev train in extreme working conditions.

2. BASIC INTRODUCTION

2.1 Operating Principle

Making comparison with conventional trains, there are two obvious differences of mid-low speed maglev train, suspension and traction. The mid-low speed train is non-contact of wheel-rail, after electrified the electromagnets that attached to the train, are oriented toward the rail from below, thus the train will levitate above the rail, which named electromagnetic suspension (EMS), and the traction force is by linear motor. The stable suspension clearance is 8 mm and the maximum speed is 140 km/h of the new type of mod-low speed maglev train.

2.2 Structure Analysis

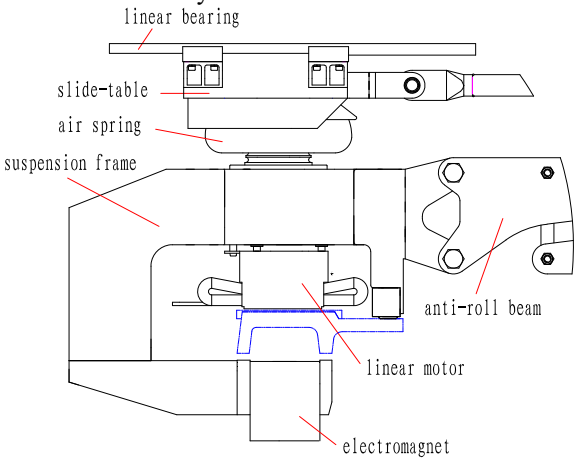


Fig 1 the structure of suspension module

A mid-low speed maglev vehicle is composed of carbody and running gear, the running gear that also known as suspension module is the motion execution unit of the vehicle, which integrates suspension frame, air spring, gap sensor, emergency wheel, linear motor, suspension electromagnet and hydraulic braking clamp device, with the function of levitation, traction, guidance and brake. This new type of mid-low speed maglev train composed of three vehicles that contains three independent suspension module, and the suspension module is divided into two symmetrical parts of left module and right module, which the left

and right sides are coupled by an antiroll beam. The main structure of suspension module as shown in figure 1.

Compared with Japanese HSST 100 series represent the most systematic technology of mid-low speed maglev train, the suspension module structure is different obviously of the new maglev train, one is each suspension module contains just an antiroll beam attached to the middle of the module, which could reduce the weight of the module by the time conducive to the left module and the right module decoupling. Another is the secondary suspension of air spring placed in the middle of the suspension frame that makes the suspension control easier. As shown in figure 2.2, the carbody is connected above the slide-table (ST) of the suspension module, just as shown in figure 2.2. The first (ST1) and the third (ST3) slide-table are directly fixed on carbody, but the middle slide-table (ST2) is connected to the carbody by linear bearing that have the effect of decoupling, so there is a lateral movement degree of freedom between carbody and the middle slide-table.

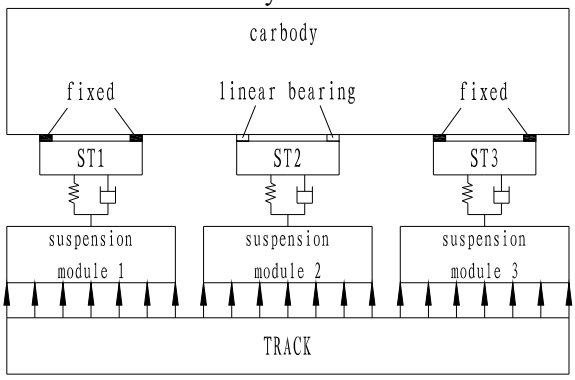


Fig 2 carbody connection diagram

2.3 Self-Steering Principle

The train will be pushed outside of the curve due to the influence of centrifugal force while curve negotiation, and the suspension electromagnet will correspond transverse move relative to F-shaped rail, the principle as shown in figure 3. The magnetic attraction force between suspension electromagnets and F –shaped rail isn't vertical upward any more, so the inclined force decomposed into horizontal guidance force Fy and vertical levitation force Fz. The orientation of Fy and Fz are opposite, which make the suspension frame derailed overcome the centrifugal force automatically revert to the original position, that namely suspension frame self-steering[15]. Benefit from the ability of decoupling of middle anti-roll beam, this new type of suspension frame compare with Japanese HSST no longer set forced-steering mechanism and still have brilliant steering ability. If the horizontal guidance force Fy isn't enough to balance the centrifugal force, the suspension frame will further migration, until lateral sliding-block that fixed on the suspension frame contact with F-shaped rail, and the friction force between two friction surfaces will assist steering, so the new maglev train could negotiate curve safely.

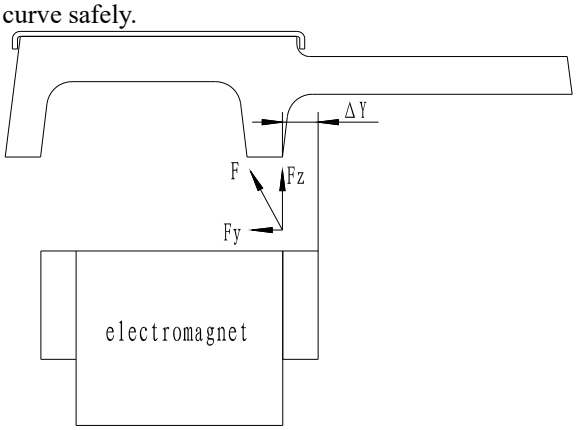


Fig 3 guidance force Fx and levitation force Fz

3. DYNAMIC ANALYSIS

3.1 Model Analysis

Each vehicle is composed of a carbody, three suspension frames which include left/right module, six slide-tables, three anti-roll beams, six traction rods. This paper assume that all components are rigid body, and the vehicle system topology structure diagram is made as shown in figure 4.

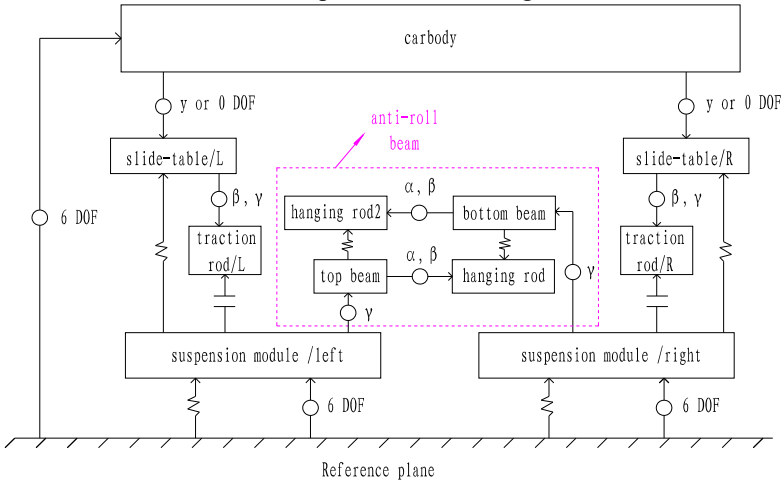


Fig 4 topology structure of a suspension module

3.2 Modeling

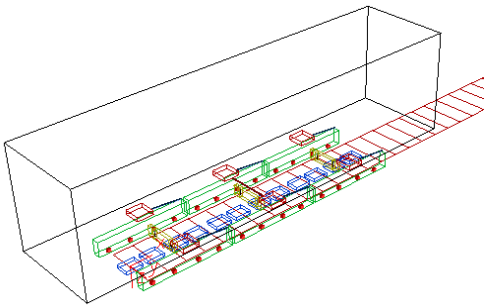


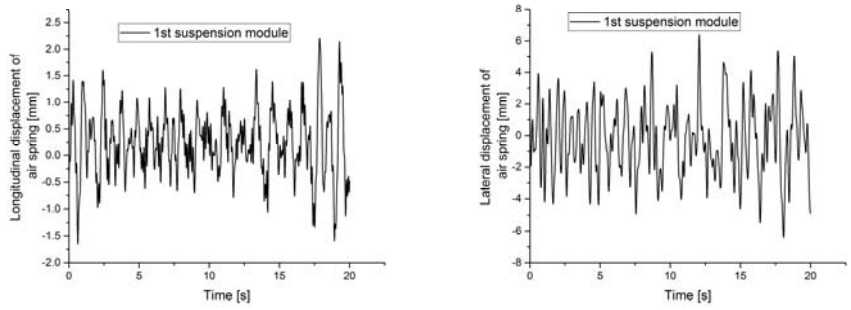
Fig 5 simulation model

The simulation model is established by using multi-body dynamic software SIMPACK, the suspension electromagnets are defined into move marker points in the model, and the force elements that between suspension frame and move marker points are built to support the whole vehicle, at the same time the track irregularity is defined through these move mark points, figure 5 is the simulation model.

3.3 DYNAMIC SIMULATION AND RESULTS

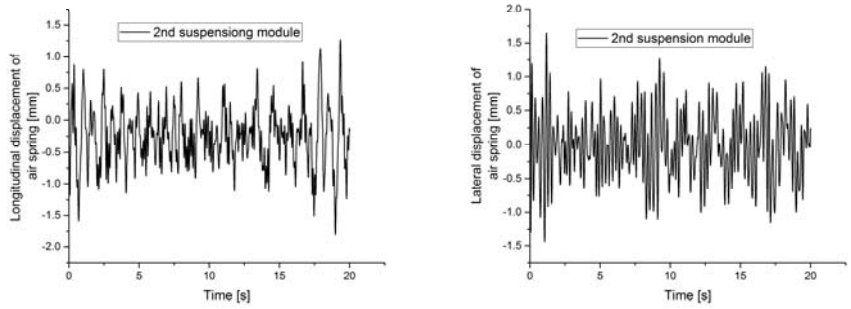
The simulation calculate is divided into two extreme working conditions, the maximum running speed of 140 km/h and negotiate the minimum curve of 50 m radius. The vehicle is in AW0 condition while calculating, and the track irregularity use German high speed low interference spectrum, mainly inspect the dynamic response of the secondary suspension of air spring.

Figure 6 to figure 8 are the calculated results of the air spring at the condition of the running speed is 140 km/h.



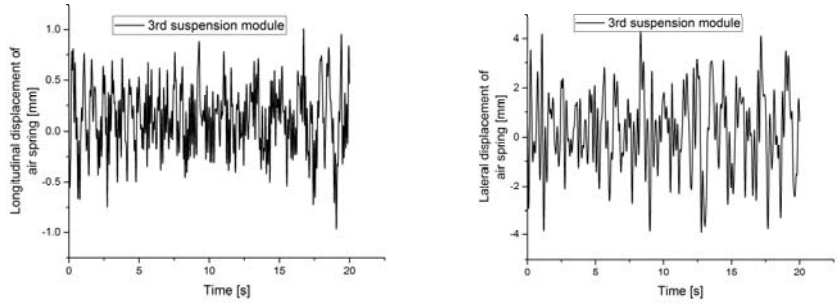
a b

Fig 6 response of air spring in the first suspension module (a lateral displacement, b longitudinal displacement)



a b

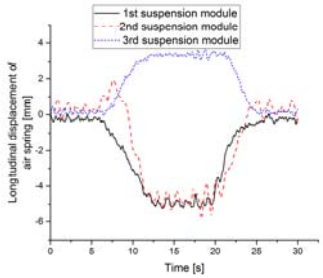
Fig 7 response of air spring in the second suspension module (a lateral displacement, b longitudinal displacement)



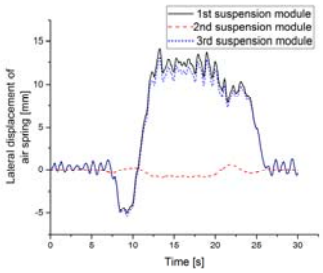
a b

Fig 8 response of air spring in the third suspension module (a lateral displacement, b longitudinal displacement)

While the vehicle negotiating the minimum radius curve of 50 m, the transition curve set 60 m and the superelevation set 200 mm and the running speed of the vehicle is 30 km/h, the simulated results as shown in figure 9.



a



b

Fig 9 response of air spring while negotiating the minimum radius curve (a lateral displacement, b longitudinal displacement)

Those simulated results show that the maximum lateral and longitudinal displacement is less than 5 mm and 2mm respectively and the extreme horizontal displacement of the air spring is 5.4 mm while the maglev train in condition of the running speed is 140 km/h. When the train negotiating the minimum curve of 50 m radius, the maximum lateral and longitudinal displacement is respectively no more than 12.5 mm and 5 mm, so the extreme horizontal displacement is 13.5 mm. The secondary suspension use the big air springs, which ensure the stability of the maglev train in any condition.

4. CONCLUSIONS

Based on the above analysis it can be concluded as followings:

(1) The dynamics simulation model of maglev train established in this paper can better simulate actual situation;

(2) The extreme horizontal displacement of the air spring is respectively 5.4 mm and 13.5 mm while the maglev train in condition of the maximum running speed and the negotiate the minimum radius curve.

(3) The displacements of air spring are both in allowed range.

5. ACKNOWLEDGEMNT

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The Digital Inkjet Printing Model of Multi-material Device

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Abstract: Functional device prototyping in one step model was researched using heterogeneous object structure. The grid node model was developed which is attached the structure and material information of heterogeneous objects. Three-dimensional heterogeneous objects can be layered manufacturing through one-dimensional and two-dimensional characteristics, the same as material distribution. Materials slice was proposed to define material of three-dimensional model. Materials slice was designed to be in accordance with the slice in physical process of RP for HEO model. Based on the material definition in 3D material distribution the slicing layer could easily be gotten for inkjet printing. The model is effective as seen in experiment part, and a sensor network in skin of robot was designed using heterogamous model and could be manufactured using 3D inkjet printer.
Keywords: Heterogeneous Object, Heterogeneous materials, feature nodes

1. INTRODUCTION

The concept of Heterogeneous Objects(HEO) comes from the matter structure of the nature, almost all the organisms, such as teeth, skin , bone , wood and bamboo are exist in the form of heterogeneous entities[1][2][3]. At present, the research for HEO has become the forefront research topics or one of the hot of the field of mechanical engineering, materials science, information science and other fields.

In allusion to different physical form of heterogeneous objects, researchers have proposed a variety of modeling methods. But the modeling aim for most of the objects is simple and regular geometry. Then effective modeling approaches for the heterogeneous objects have not yet appeared.

Fig.1 shows an example of material distribution of heterogeneous object, which contains two or more kinds of materials at different position, or the material distribution is irregular.

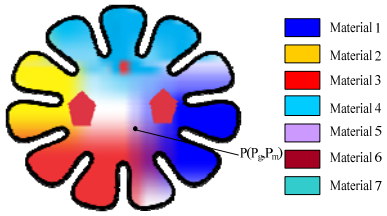


Figure 1 Multiphase material model.

Complex distributing heterogeneous objects, a hybrid modeling method for heterogeneous objects is presented which could be used in micro device prototyping manufactured by 3D inkjet printer.

2. THE GRID NODES BASED GEOMETRIC MODELING

The modeling model of heterogeneous objects divided into geometric modeling and materials modeling. Many scholars have proposed a variety of modeling methods, based on the structure and material form changes of the heterogeneous entity, the various types of modeling methods for the HEO were divided into three categories: static modeling, the dynamic modeling methods and hybrid modeling method.

The static HEO modeling method is suitable for the description of the physical structure and material distribution of stable HEO. The class modeling method of HEO is most concentrated, then the lesser of the latter two research is still in the exploratory stage[4] .

Among many HEO modeling methods, the more representative are: Dutta[5][6] adopted *r-set* for describing geometry information and r_m*-set* for describing material information to express synthetic HEO, the modeling method based on R-Rep, and using geometric space to describe the geometric information; Jackson[7] studied the finite element mesh to describe the geometry information, synthetic modeling for HEO based on the distance of unit node to entity boundary as the variable to describe the material characterized, the method of data processing broken down heterogeneous entity to irregular tetrahedral units, data computing and slices layered are more complex; Tan[8][9][10][11] studied the modeling method of gradient source and feature tree, and more systematic study the CAD design and visualization of synthetic HEO, and developed prototyping software; Wu[12][13] employed the voxel model based on the distance field to describe the synthetic HEO, and developed a prototype for HEO CAD software; Fadel[14][15] proposed the modeling methods based on the voxel point and spatial curve control points, and FEA and forming methods of heterogeneous entity were studied.

The above methods are specifically refer to heterogeneous objects, which have static geometry modeling, no infiltration or variation between the multi-material, and the material phase has obvious boundaries, or gradient changes. Indeed they do not

take the distribution of the material phase into account, such as non-homogeneous, irregular or material distribution change over time.

This method of the mesh refined STL model and micro-tetrahedral cell to rebuild geometric model and define material information respectively is presented. The design process showed in Fig. 2 .

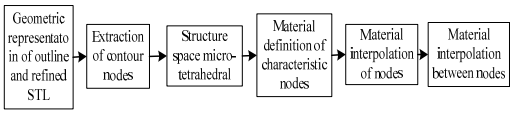


Figure 2 Design process of CAD model.

2.1 Space Tetrahedral Structure Of Heterogeneous Objects Model

In order to assume the single material model and the uniform texture as a precondition for the STL generic model, therefore, even if the point clouds set after refining just have the surface node geometric information without internal structure information of the heterogeneous objects model[16]. The material information is attached to the structure information of heterogeneous objects model, aim for expressing material information, in particular the internal materials distribution which requires a suitable way to describe the internal structure of heterogeneous objects model.

Based on the aforementioned point clouds set has been obtained, using incremental algorithm of Delaunay triangulation method[17] [18] (also known as point-by-point method), constructing micro-tetrahedron structure for internal entity representation model of new heterogeneous objects. Then in accordance with the decomposition process shown in Fig.3 by the internal micro-node tetrahedral model to construct a new grid nodes set. The difference between the space point clouds and the surface point clouds is that the model not only has the internal and external surfaces information but also has the internal structure information and internal topology information between nodes, in the end this heterogeneous objects model laid the material foundation for the definition of further material information.

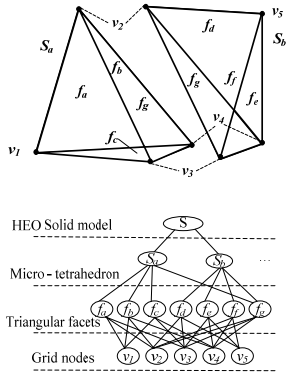


Figure 3 The grid nodes for CAD model of HEO

2.2 Feature Nodes Based Material Modeling

The process of the material assignment for nodes, defining the material of each feature node in advance, the subsequent material interpolation operation is carried out between the nodes.

On the basis of new geometric model containing space micro-tetrahedron formed by the uniform point clouds of refined STL model, to design the material according the physical characteristics and materials distribution characteristics.

During the design and analysis process of heterogeneous objects, it's more effective [19] to control material distribution by controlling over characters than material distribution single.

Therefore, in materials modeling process of this research, bringing in the material distribution characteristic values for describing the physical characteristics, the volume percent of each material and material distribution vector. The characteristics nodes of CAD model for heterogeneous objects, are along the X, Y, Z axes for three-dimensional spare material assignment respectively of the multidimensional, in accordance with in Eq.(1) .

$$M_p = (s_1, s_2, ..., s_k, x_1, x_1', y_1, y_1', z_1, z_1', ..., x_k, x_k', y_k, y_k', z_k, z_k') \quad (1)$$

Among, k stands for the total number of species of materials contained in the model; si indicates the i-th material distribution eigenvalue at P-node, and its value is the product between the volume percent of i-th material mi and its physical characteristics. By the way, the sum of volume percent of all materials should be 1, and the material features of P point are showed in Eq.(2).

$$\begin{cases} s_i = f_i \cdot m_i \\ \sum_{i=1}^{k} m_i = 1, m_i \in [0,1] \\ f_i = \begin{cases} 1 & \text{(contain i - th material)} \\ 0 & \text{(without i - th material)} \end{cases} \end{cases} \quad (2)$$

$$\begin{cases} x_i = Mp_{i+1}(s_i, x) / Mp_i(s_i, x) \\ x_i' = Mp_{i-1}(s_i, x) / Mp_i(s_i, x) \\ y_i = Mp_{i+1}(s_i, y) / Mp_i(s_i, y) \\ y_i' = Mp_{i-1}(s_i, y) / Mp_i(s_i, y) \\ z_i = Mp_{i+1}(s_i, z) / Mp_i(s_i, z) \\ z_i' = Mp_{i-1}(s_i, z) / Mp_i(s_i, z) \end{cases} \quad (3)$$

Where, k for the total number of material species contained in the model; k represents the body components of the i-th material at P-node, the sum of body components of all materials should be 1; x_i and x_i' *are* the distribution vector of i-th material at the two opposite directions along the X-axis respectively, to indicate the changes trend of the material. The value is the ratio of the material body component between the node and next node along X direction. The greater the absolute value of the vector, indicating that the more intense material change around this point. The vector equal to 1 means the

same body component of the node and the next node, 0 means that the contour points,-1 means the same material body component with the prior node, $+\infty$ means the point does not contain this material, but the neighboring direction containing the material; yi and yi ' are similar as defined, see the Eq.(3).

Three-dimensional heterogeneous objects can be layered manufacturing through one-dimensional and two-dimensional characteristics, the same as material distribution. In the study, we propose the concept of "materials slice" to define material of three-dimensional model. Meanwhile, the "materials slice" can be in corresponding to the "slice" in physical process of RP for HEO model.

As an example of modeling of these materials, the Fig. 4 (a) shows the six-tooth model. Assume that the outer surface of the model and the hole are two pure materials, the middle part is the transition area of the two materials. Fig. 4 (b) shows a two-dimensional material slice of a three-dimensional model, P and Q point both the surface geometry nodes and material characteristics nodes, and the remaining thick black dot (except P' spot) are the two-dimensional characteristics nodes which are the former space point clouds mapped to two-dimensional layer. Here the space point cloud means the nodes from above layer which adjacent to the slice mapped to the layer (the adjacent degree depends on the thickness of the slice), so the grid mapping nodes can be obtained in the slice layer.

Using Eq.(1) ~ (3), the material value of P and Q point should be: P(1, 0, 1, 0, 0,y_1' , 1, -1, null, null, null,y_2', null, null) and Q(0, 1, null, -, +, null, null, null, 0,x_2',y_2, 0, 1, -1) respectively .

Where, null means that the point and the adjacent nodes don't have the material; the specific value $y_1'$of P node can be determined by Euclidean distance Eq.(4)(P' is the anti-direction adjacent node), and the values of y_2' , x_2', $y_2$can be calculated in the same way.

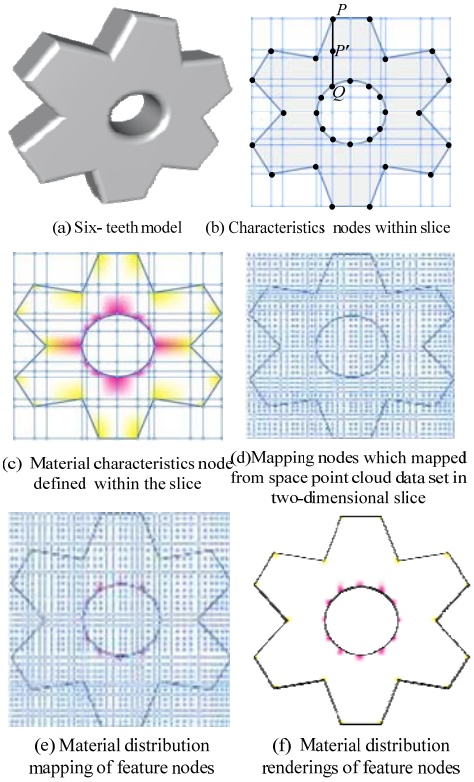
$$y_1' = -d(P,P')/d(P,Q) \tag{4}$$

In accordance with the above methods to define material information for each characteristics node , and in turn the material distribution of characteristics node within the slice is obtained , showed in Fig. 4 (c).

Because that the characteristic nodes of each object only occupy a very small proportion relative to the number of spatial point clouds. The accuracy of the material distribution throughout the three-dimensional model will be very low when direct interpolating the defined characteristics nodes solely.

To improve the accuracy of material described, combined with the existing spatial point clouds, and the spatial point clouds is mapped to the selected slice layer, then we can obtain the mapping the grid nodes within the slice layer , Fig. 4 (d) below .

Fig. 4 (e), (f) are the material distribution and renderings after mapping grid. In contrast with Fig. 4 (c), we can see that the accuracy of material distribution has greatly been improved after mapping the grid.



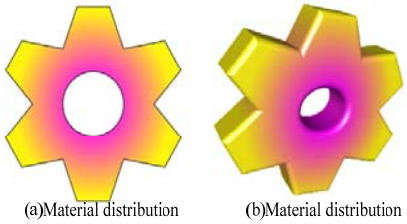
(a) Six- teeth model (b) Characteristics nodes within slice

(c) Material characteristics node defined within the slice (d)Mapping nodes which mapped from space point cloud data set in two-dimensional slice

(e) Material distribution mapping of feature nodes (f) Material distribution renderings of feature nodes

Figure 4 Material characteristics nodes defined within the material slice.

Based on the above material definition processes for each slice layer, we could complete materials definition of the three-dimensional heterogeneous model. Fig. 5(a) shows two-dimensional rendering of the material distribution within each slice shown in Fig. 5(b) telling the rendering of three-dimensional materials distribution contained two kinds of materials.



(a)Material distribution renderings of the slice (b)Material distribution renderings of HEO model

Figure 5 The material distribution renderings of 2D slices and 3D model.

3. HETEROGEOUS MODEL USING IN DEVICE DESIGN

We design a skin model of robot which has sensor function, and the circuit of sensor distributed on the surface. The model was designed for inkjet printing manufacture. The surface materials distribution design shown in Fig.6, Fig.7 is the inner material distribution mutation of surface model.

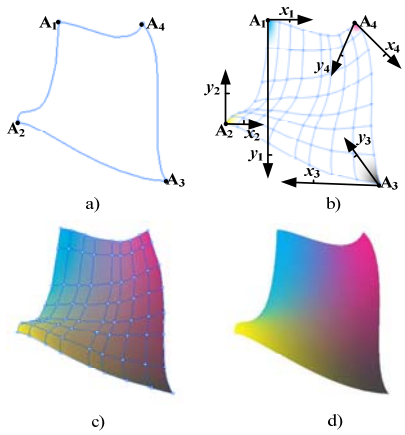
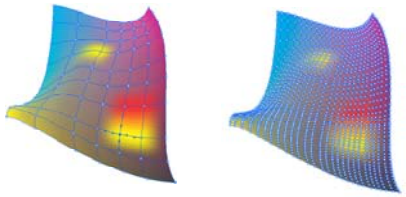


Figure 6 Surface multiphase materials distribution design.



a） b）

Figure 7 inner material distribution mutation of surface.

4. CONCLUSIONS

The internal nodes of tetrahedral divided into two processes: Firstly, aim for the nodes of the surface model of heterogeneous objects, which can be directly through the vertex of each triangular in the refinement STL surface model. secondly, after uniform interpolation for the surface nodes and to get the rules internal point clouds. Such point clouds was arranged in a matrix rules, its advantage is to guarantee the consistency of the surface nodes in the refined STL model and the surface nodes in space tetrahedron, meanwhile, facilitate the rapid construction and orderly data storage of the internal micro-tetrahedron structure. This method has important theoretical and practical significance in device prototyping in one step.

5. ACKNOWLEDGEMENTS

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SVM Vehicle Identification based on LSD Method for Triangulation and Mesh Vector Feature

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Abstract: For video image vehicle recognition, image analysis, pattern recognition, SVM algorithm is used, under the traffic scene vehicle identification were studied. Here is the extraction of video image geometric features of the vehicle identification, this geometric feature extraction process including LSD line detection, triangulation points convex polygon detection and recognition and counting based on grid motion vector. The improved method is simple and efficient, and has strong adaptability to the complex background and vehicle identification under different illumination conditions.
keywords: Triangular subdivision; LSD; Vehicle identification; Motion vectors

1. INTRODUCTION

Vehicle identification is a kind of object extraction problem in a complex background, and it is a hot issue in the research of video image processing. There have been many scholars in this area have been studied.

vehicle identification technology has many problems to be solved. Such as for speed changing larger movement of the target, larger size, internal color consistent with the goals, not effective recognition; to be measured vehicle area susceptible to illumination condition changes, the background changes caused by error detection and so on.

Vehicle identification is a kind of moving vehicle detection, the commonly used moving target detection methods include video frame difference method[7], optical flow method[8] and background difference method[9]. These methods are mainly aimed at a number of video image frame detection, according to the characteristics of vehicle information, vehicle identification, no mining of geometric features. So before the vehicle samples can be correctly identified, the geometric features of the video stream is extracted accurately and timely.

2. ALGORITHM IMPLEMENTATION

Extraction of geometric features is by observing the video of the vehicle motion state and rules to extract vehicle geometric features in the video stream, and vehicle characteristics than traditional methods, and the classification of SVM classifier to achieve vehicle identification, specific improvement is using LSD method for detecting lines, replacing the traditional method of probabilistic Hough transform line detection method, avoids the parameter selection and reduced the detection error and improve the effective to solve the complex environment in vehicle recognition and poor real-time problems.

According to the classification of SVM, the first half of the video is used as the training sample, and the normal vector parameters of the classified hyper plane are obtained. The latter half of the video is used as a test sample for vehicle identification and detection. According to the principle of topology, the video in the outline of the vehicle can be characterized by a convex polygon, and the convex polygon is a notable feature of the for two horizontal lines. So it is only needed to capture a convex polygon with such a special line in the video stream and has the characteristic of displacement. The detection of convex polygons can be completed by triangulation, the required points set by LSD to detect the line segment endpoint.

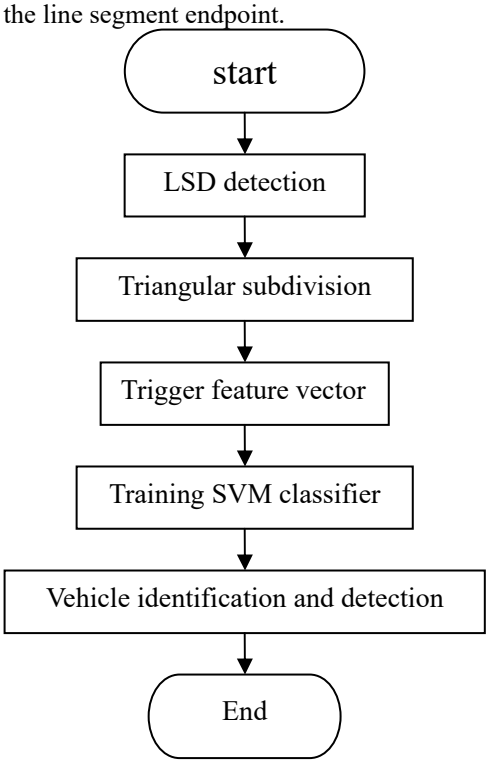


Fig. 1 flow chart of geometric feature extraction

2. VEHICLE IDENTIFICATION GEOMETRY FEATURE EXTRACTION

2.1 Lsd Local Linear Detection Principle

LSD method for rapid detection of input images of the local linear segment[1]. It can get the results of sub pixel level accuracy in linear time. The advantage of this algorithm is that it is not necessary to adjust the parameters of any digital image. This method can effectively control the number of false detection. Effectively solve the traditional probabilistic Hof linear detection algorithm in real time as well as the difficulty of parameter selection[2].

The flow chart of the algorithm is as follows:

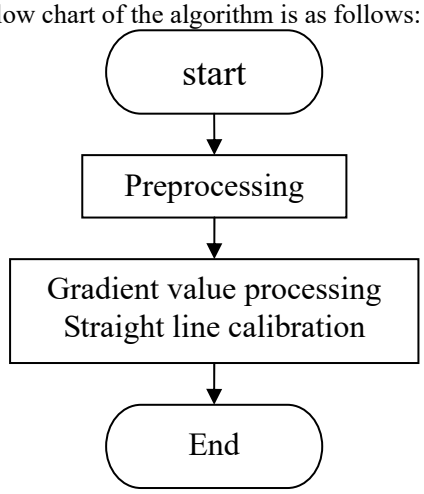


Fig. 2 flow of LSD algorithm

2.2.1 preprocessing

In order to facilitate subsequent processing, the part includes image scaling and gradient calculation and linear calibration. Image scaling is set to 80%, which can effectively solve the aliasing phenomenon, at this time the total pixel into the original 64%, the reduction is achieved through the Gauss kernel filtering and sampling to achieve[10]. Gauss's standard deviation is the origin of the decision, and the S is the scaling factor, the parameter is set to 0.6, in order to maintain the balance between the serrated effect and image blur[16].

Vehicle features in video images exist in some special areas, which can be directly obtained from these areas to determine the vehicle[15]. And these special areas are determined by straight line, so first by calculating the number of pixels in the digital image near the point of view of the horizontal line, and thus generate the horizontal line area, that is, the unit vector field. Which tolerate a certain degree have the same horizontal line angle is the line support regions, and then use the 2*2 template image gradient values were calculated, here is the image pixel gray value, the gradient of the image by the following formula to calculate:

$$g_x(x,y)=\frac{i(x+1,y)+i(x+1,y+1)-i(x,y)-i(x,y+1)}{2} \quad (1)$$

$$g_y(x,y)=\frac{i(x,y+1)+i(x+1,y+1)-i(x,y)-i(x+1,y)}{2} \quad (2)$$

The horizontal angle by the calculating formula:

$$\arctan\left(\frac{g_x(x,y)}{-g_y(x,y)}\right) \quad (3)$$

Gradient magnitude:

$$G(x,y)=\sqrt{g_x^2(x,y)+g_y^2(x,y)} \quad (4)$$

2.2.2 gradient value processing and linear calibration

In order to get the gradient value, it is usually used to detect the line segment from the pixels with the highest gradient magnitude, and choose the appropriate gradient threshold.

The expression of judgment criterion is $|\text{angle error}| \le \arcsin\left(\frac{q}{|\nabla i|}\right)$,

Then the regional growth, straight line segmentation corresponds to a rectangle (separated out of the line can be represented by an external rectangle). Before the line support area is evaluated, the corresponding area is framed.

Area of view updates can be represented as $\arctan\left(\frac{\sum_j \sin(\text{level-line-angle}_j)}{\sum_j \cos(\text{level-line-angle}_j)}\right)$, Finally, the two horizontal lines of the vehicle area in the video image are determined by the estimation of the rectangle, the center and the direction of the rectangle are determined by the following formula

$$c_x=\frac{\sum_{j\in Region} G(j)gx(j)}{\sum_{j\in Region} G(j)} \quad (5)$$

$$c_y=\frac{\sum_{j\in Region} G(j)gy(j)}{\sum_{j\in Region} G(j)} \quad (6)$$

$$M=\begin{pmatrix} m^{xx} & m^{xy} \\ m^{xy} & m^{yy} \end{pmatrix} \quad (7)$$

Here, $G(j)$ it is the gradient magnitude of the pixel j, and the subscript j is used to traverse all the pixels in the rectangle.

$$m^{xx}=\frac{\sum_{j\in Region} G(j)g(x(j)-c_x)^2}{\sum_{j\in Region} G(j)} \quad (8)$$

$$m^{yy}=\frac{\sum_{j\in Region} G(j)g(y(j)-c_y)^2}{\sum_{j\in Region} G(j)} \quad (9)$$

$$m^{xy}=\frac{\sum_{j\in Region} G(j)g(x(j)-c_x)g(y(j)-c_y)}{\sum_{j\in Region} G(j)} \quad (10)$$

200th frames 455th frames

679th frames

Figure 2 line detection in video images

2.3 Vehicle Convex Polygon Extraction based on Triangulation

In the correct detection of the image in the horizontal line, the recognition of the convex polygon between the horizontal line is the key link of vehicle identification, the difficulty lies in the detection of convex polygon. Input endpoint sets can be determined by the last step of the line segment endpoint[3]. The convex polygon can be identified in linear time by using triangulation[11]

For a particular area Delaunay triangulation, first distribution and boundary discretization, the mesh object from the regional conversion point set, within the region of the points is a straight line segment endpoints; the endpoints of the inner and outer boundaries of discrete and according to the needs of the layout of interior point composed of the input point set by the topological structure of minutiae triangular partition,The divide and conquer algorithm of triangular mesh.

In this paper, the following 3 properties are used in the triangulation method:

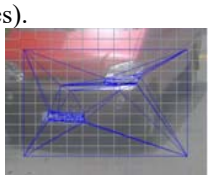
One: Always unique;

Two: Empty circumcircle property;

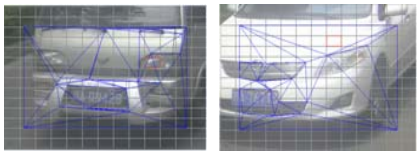
Three: Maximum minimum angle principle.

From the above analysis, we can know the end point set of Delaunay triangulation is indeed a suitable triangulation[4].

The core algorithm using triangulation detection of convex polygons: first with a large triangle all the ends of the line surrounded in them, and then choose a traversal method, in turn will focus points connected by triangles, for each new point, may have some do not meet the nature of the triangle, in order to eliminate the illegal edge, for each possible illegal edge edge over the rotor call function, the illegal edge all into legal edge, we note that any legitimate side of the original, only in its associated (up to two) triangle one of the changes, it may become an illegal edge. As a result, we only need to check the newly generated triangles (all sides).



268th frames



350th frames 780th frames

Fig. 4 triangulation of the convex polygon

2.4 Grid Vector Detection

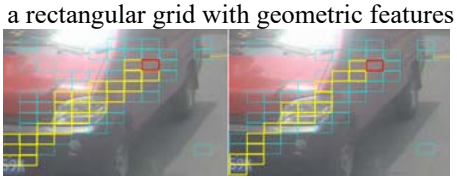
Through the above two steps, has received the vehicle geometric features of the input image in the presence of further below that there are vehicles also need to verify these mesh The mesh motion vector of video image occurred displacement of convex polygons were detected, determine in advance a trigger state, get from the triangulation contains a rectangular grid of convex polygon boundary point and then get the subscript of the center of gravity of the rectangular grid.

This step makes the vector displacement with quantitative characteristic, then verify trigger state whether meet the triggering criteria, triggering criteria for when the target mesh motion vector pointing to the right and more than one third of the maximum triangle hypotenuse and trigger state release certificate to identify vehicles.

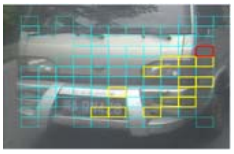
266th frames 417th frames

800th frames

Fig. 5 a rectangular grid with geometric features



190th frames 528th frames



739th frames

Fig. 6 mesh motion vector

3. VEHICLE IDENTIFICATION BASED ON GEOMETRIC FEATURES OF SVM

3.1 SVM Basic Principles

The support vector machine is based on the linear division. The principle of support vector machine is to map points in low dimensional space to high dimension space, so that they can be linearly separable. Use the principle of linear division to determine the classification boundaries and the

Lagrange function with optimization problems and constrained, and then use the duality theory, the classification of the above optimization problem is obtained.

3.2 the SVM classification method in this paper

Firstly, the vehicle identification problem is expressed as a function f(x), and the maximum interval method is used to calculate the classification surface.

The classification boundaries are translated from the two classes of points separately, until the first data point is encountered.

The equation of classification surface is: $\left(\mathrm{w}\mathrm{g}\mathrm{x}\right)+\mathrm{b}=0$ .The x multi-dimensional vector. The reciprocal of the classification interval is $\frac{1}{2}\|\mathrm{w}\|^2$.

So the optimization interval problem is expressed as:

$$\min \frac{1}{2}\|\mathrm{w}\|^2 \quad (11)$$

$$\text{s.t. } \mathrm{y}_\mathrm{i}\left(\left(\mathrm{w}\mathrm{g}\mathrm{x}\right)+\mathrm{b}\right)+1\geq 1,\mathrm{i}=1,2,3 \quad (12)$$

One of the constraints is the:

Requesting every data points $\left(\mathrm{x}_\mathrm{i},\mathrm{y}_\mathrm{i}\right)$ the distance to the classification surface is greater than or equal to 1 .Among them, y_i is the classification of data.

Its value is 1 when the vehicle is identified, among $\mathrm{w}=\left(\mathrm{w}_1,\mathrm{w}_2,\mathrm{w}_3\right),\mathrm{w}_\mathrm{i}\in\{0,1\}$ X_1 is 1 represents a straight line detected by LSD. X_2 is 1 said using Delaunay triangulation to detect convex polygon, X_3 is the 1 represents the characteristic grid vector to the right to move a certain distance. The video file is divided into two halves, that is, the first three minutes of the video to be used as a training sample, the geometric features detected by the first to determine the input vector X , Further to determine the w vector value of the algorithm, and then select the second half of the video (4500 frames) as a test sample to test the effect of recognition.

4. EXPERIMENTAL RESULTS

In this experiment the video file for the district toll station video camera recorder. 1000th and 1800th respectively represent the frame vision and close range under the condition of the feature extraction process, can see that the vehicle is far from the camera also, can extract relevant features;

2300th frames and 2480th frame represents before and after the two car is close to the situation, can see the distance, geometric features after the car can still be correctly extracted;

2590th frames and 2697th frames of ratio shows that this recognition method not affected by the color of the vehicle detection;

3770th frame format and 3892nd frame display for different models (high and low, the baffle plate) algorithm is correct to extract relevant features;

3978th frames (4100th frames (cloudy) and It is proved that the geometric feature extraction processes has no effect on the different light, temperature, density, conditions, which effectively ensures the correct classification of SVM.

First frames

Figure 6 initial state

This identification method has a strong anti-interference ability, for every normal recognition in fast or slow moving different sizes of different colors of the target vehicle, and non vehicles (bicycles, pedestrians) would not be recognition errors:

2355th frames 2870th frames

Fig. 7 non recognition of travel and non vehicle

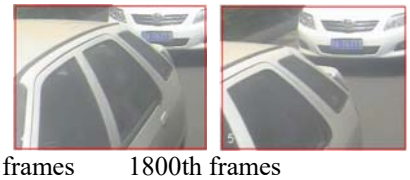
Finally, the above treatment process, the use of different methods of vehicle identification is as follows:

960th frames 2300th frames

2475th frames 3780th frames

3892th frames 4300th frames

Fig. 8 results of SVM recognition under the traditional PPHT method



1000th frames 1800th frames

2300th frames 2480th frames

3770th frames 3892nd frames

Fig. 9 recognition results of SVM under LSD method

According to the actual video test, for the traditional identification methods: the third and fourth car didn't identify the, the ninth and tenth vehicles for repeats recognition; improved method: only the fourth cars were repeated to identify. So the recognition accuracy is 90%. The average treatment time was 15.6fps.

5 CONCLUSIONS

Through the vehicle identification test in different video streams, the test results show that the method can effectively and reliably identify the vehicle in the video image. Its characteristic lies in:

(1)This paper presents a geometric characteristic of vehicle based on video image recognition to achieve recognition of vehicles, compared with the traditional recognition and vehicle license plate and achieve vehicle identification, has the advantages of simple algorithm, high recognition rate and accurate.

(2)In this paper, a geometric detection method based on the combination of LSD line detection and triangulation is proposed, which can effectively highlight the characteristics of the vehicle.

(3)In the application of grid vector motion using the geometry of the motion feature, and the vector of the state recorded in the Boxes, in a continuous video frame by observing the movement of the vector control, making the recognition more accurate.

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A Simulation of Martensitic Transformation of Quenched Cold-Rolled Mild Steel

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Abstract: In order to predict the characteristics of martensite phase transformation after quenching for the low carbon steel. The model for the driving force as well as for the volume fraction of the martensitic transformation has been built based on the thermodynamics and kinetics of martensitic transformation. Numerical simulation was conducted for the martensitic transformation at three cooling rates to figure out the relation between volume fraction and temperature at different cooling rates, and martensite phase transformation characteristics at room temperature. Comparison between experimental observations and model results show that the numerical simulation has a high precision with very small computational errors, lower cooling rate, forming large martensite for strip and has fine ferrite between strips, while the cooling speed reached 280 ℃ /s, the high temperature austenite almost transformed into martensite.
Keywords: Mild steel; Martensitic transformation; Quenching; Simulation

1. INTRODUCTION

Cold-rolled mild steel is mainly used in auto and household appliance industries, etc. After the cold-rolled steel being heated to temperature above Ac1, the cooling process of austenite determines the final tissues and properties of the product. Martensitic transformation during the quenching of austenite is one of the important solid-state phase transformations in material science. Austenite-martensite transformation can be deemed as a process of formation and growing of nucleuses, and the transformation speed depends on the nucleation rate as well as on the growth rate.

Liu Zhenyu and Wang Guodong, et al.[1,2] made use of different transformation thermodynamics and kinetics models to calculate the equilibrium temperature and equilibrium concentration of the transformations of ferrite, pearlyte and bainite during the cooling process of the hardened austenite, achieving the prediction on the tissues and properties of hot-rolled steels.

In this article, we studied the transformation of mild steel from austenite to martensite during the quenching process, built a thermodynamics and kinetics model of martensitic transformation, and simulated the transformation by using MATLAB. Comparison between experimental observations and model results show that the numerical simulation has a high precision with very small computational errors.

2 MATHEMATICAL MODEL OF MARTENSITIC TRANSFORMATION

The thermodynamics of phase transformation is basis for figuring our the equilibrium state and can provide important parameters for the kinetics of phase transformation. Such kinetics is to, from the angle of kinetics, analysing the relations between the speed, the amount and the time of transformation.

2.1 Thermodynamic Calculation Of Γ → M Transformation

Martensitic transformation is in fact diffusionless coherent shear transformation, that is to say, two original adjacent atoms will be still adjacent after transformation and the relative displacement between the two atoms is less than the size of a atom. In a diffusionless transformation, the components of parent phase are same to those of the new phase, namely, there are no changes in the components before and after the transformation. For the thermodynamics of martensitic transformation, therefore, we only have to consider the relation between free energy and temperature[3].

The free energies (G) of both martensite and austenite that have the same components decrease as the temperature increases. Because the decreasing rates are different, the two curves meet each other at the thermodynamic temperature (Ts) of phase equilibrium, as shown in fig. 1. Austenite below the temperature Ts will change to α' phase from face-centered cubic lattice to body-centered cubic (square) lattice with the same components.

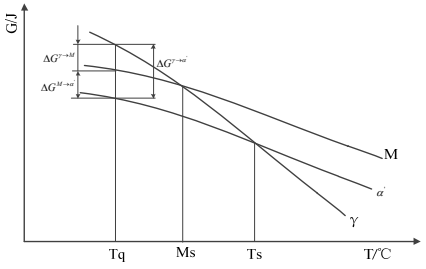


Figure 1 Relationship between temperature and free energy of martensite ferrite and austenite

Fig. 1 shows that the driving force of martensitic

transformation is the difference in the chemical free energies between martensite (new phase) and austenite (parent phase), and can be expressed as[4, 5]:

$$\Delta G^{\gamma\to M}=\Delta G^{\gamma\to\alpha'}-\Delta G^{M\to\alpha'}=\Delta G^{\gamma\to\alpha'}+\Delta G^{\alpha'\to M} \tag{1}$$

where, $\Delta G^{\gamma\to\alpha'}$ represents the difference between the chemical free energies when austenite changes to α' phase, and can also be called as the driving force at the critical phase transformation of $\gamma\to$M transformation. This part of energy is used to stabilize the nucleuses that forming the body-centered cubic structure of austenite transformation. During the transformation from the face-centered cubic lattice to body-centered cubic (square) lattice, the nucleuses of martensite are first formed in microstructural areas. Such body-centered cubic nucleuses can form, based on specific conditions, into either stable marteniste or block-shaped ferrite or pearlitic ferrite. The driving force for at the critical phase transformation can be defined as[6]:

$$\begin{aligned}\Delta G^{\gamma\to\alpha'}&=\left(1-x_C^{\gamma}\right)\Delta G_S^{\gamma\to\alpha}+RT\left[x_C^{\gamma}\ln\frac{a_C^{\alpha}}{a_C^{\gamma}}+\left(1-x_C^{\gamma}\right)\ln\frac{a_S^{\alpha}}{a_S^{\gamma}}\right]\\&=\frac{RT}{(Z_\alpha-3)(Z_\gamma-1)}[(Z_\gamma-1)(3-Z_\alpha x_C^{\gamma})\ln(3-Z_\alpha x_C^{\gamma})\\&-(Z_\alpha-3)(1-Z_\gamma x_C^{\gamma})\ln(1-Z_\gamma x_C^{\gamma})+(Z_\alpha-3Z_\gamma)(1-x_C^{\gamma})\ln(1-x_C^{\gamma})\\&-3(Z_\gamma-1)(1-x_C^{\gamma})\ln 3]+x_C^{\gamma}[\Delta\overline{H}_\alpha-\Delta\overline{H}_\gamma-(\Delta\overline{S}^{xs,\alpha}-\Delta\overline{S}^{xs,\gamma})+(1-x_C^{\gamma})\Delta G_S^{\gamma\to\alpha}\end{aligned} \tag{2}$$

where, $\Delta G^{\alpha'\to M}$ represents the free energy required for nucleuses to form stable marteniste, which, in fact, is the resistance of phase transformation, including following items[7,8]:

1) Energy required for changing the structure and shape of crystals during the shear transformation of martensite, and is expressed as:

$$\Delta G_{\mathrm{m}}=\frac{1}{2}V_m\phi[\sigma_i+K_Y d^{-\frac{1}{2}}]_{M_s} \tag{3}$$

2) Energy required for the shear transformation of austenite around the martensite, and is expressed as:

$$\Delta G_{\gamma}=\frac{1}{2}V_\gamma\phi[\sigma_i+K_Y d^{-\frac{1}{2}}]_{M_s} \tag{4}$$

3) Strain energy caused by the expansion of massic volume, and is expressed as:

$$\Delta G_E=\frac{1}{2}EV_m[\sigma_i+K_Y d^{-\frac{1}{2}}]_{M_s} \tag{5}$$

4) Energy (Γ_d and Γ_t) stored inside the martensite and required for forming dislocation or twin crystals;

5) Interfacial energy (Γ_m) between austenite and martensite as well as between lath martensites;

6) Other energies: surface enery (Γ_s), magnetic field energy f(M), stress field energy f(s), and parent phase defect energy f(D).

By adding up all these energies we can get the resistance $\Delta G^{\alpha'\to M}$ of martensite transformation, that is:

$$\begin{aligned}\Delta G^{\alpha'\to M}&=\frac{1}{2}[(V_m-V_\gamma)\phi+EV_m](\sigma_i+K_Y d^{-\frac{1}{2}})_{M_s}\\&+\sum\Gamma+f(s)+f(M)+\cdots+f(D)\end{aligned} \tag{6}$$

where, Vm:the molar volume of martensite (mol·m-3);

Vγ: the molar volume of austenite (mol·m-3);

φ: shear angle (rad)

E: dependent variable for volume expansion (%);

KY: unpinning stress of dislocation (MPa), and;

σi:lattice resistance of dislocation motion (MPa).

A great number of experiments and studies show that the resistance of phase transformation can be, without consideration of out-fields, calculated as[9]:

$$\Delta G^{\alpha'\to M}=2.1\sigma+900(\mathrm{J}\cdot mol^{-1}) \tag{7}$$

where, σ is the yield strength (MN·m-2) of parent phase as Ms.

The yield strength of pure γ-Fe is 130 MN·m-2 is at 800K, and the strength will be increase by 28 MN·m-2 for every increasing of 1at%C, while increased by 20 MN·m-2 for every decreasing of 100K. Hence, σ can be expressed as:

$$\sigma=130+2800x_C^{\gamma}+0.2(800-T) \tag{8}$$

2.2 Kinettic Model Of Of Γ→M Transformation

Martensitic transformation means the the super-cooled austenite transforms in low temperatures. It is the reconstruction of crystal lattices happening at the interface between the parent phase and new phase in the metal. On the surface of the polished martensite specimen after transformation, tilting will occur and form the surface relief[10]. The crystallographic feature of martensitic transformation is that there is a certain orientation relationship between the parent phase and new phase. Fig. 2 shows the microstructure of lath martensite formed during the transformation of the low carbon steel.

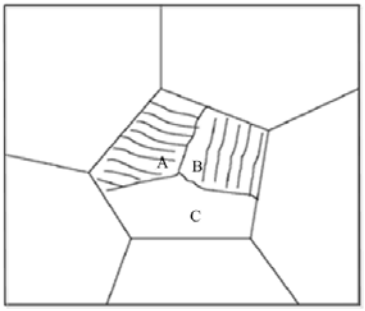


Figure 2 Schematic diagram for microstructure of lam martensite

Martensite in carbon steel is transformed as the temperature changes. During the cooling process, the transformation will occur and form lath martensites when the temperature decreases to

below Ms. Two adjacent lath martensites are, basically, parallel. Such parallel lathes then are formed into independent groups. The martensite keeps transformed as the cooling process continues, and the amount of transformation depends on the temperature Tq while has nothing to do with the duration of staying at certain temperatures.

When austenite transforms into martensite, the number of new martensite pieces within a unit volume is dN, and the driving force for the transformation is increased by $\mathrm{d}\Delta G^{\gamma\to M}$. In addition, the amount of martensitic transformation is in direct proportion to stress, so we can get:

$$\mathrm{d}N = -\varphi \mathrm{d}(\Delta G^{\gamma\to M}) \tag{9}$$

where, φ is the coefficient of proportionality equaling to -0.011.

Given that $\overline{V}$ is the average volume of the new formed martensite pieces, and; the change of the number of the new martensite pieces is $\mathrm{d}N_V$, then the change of the volume fraction of martenisite can be defined as:

$$\mathrm{d}X_M = \overline{V}\cdot \mathrm{d}N_V = \overline{V}\cdot(1-X_M)\mathrm{d}N \tag{10}$$

When the mild steel forms into martensite from the super-cooled austenite, the temperature at which the martensitic transformation starts is relatively high, and there may exist carbon diffusion. Here we ignore possible carbon diffusion. Consequently $\Delta G^{\gamma\to M}$ is function of only temperature, that is:

$$\mathrm{d}\Delta G_V^{\gamma\to M} = \frac{\partial \Delta G_V^{\gamma\to M}}{\partial T}\mathrm{d}T \tag{11}$$

Then, the change of the volume fraction of martenisite is:

$$\mathrm{d}X_M = -\overline{V}(1-X_M)\varphi[\frac{\partial \Delta G_V^{\gamma\to M}}{\partial T}\mathrm{d}T] \tag{12}$$

By integrating the above equation with the temperature T changing from Ms（XM=0） to Tq, we can obtain the volume fraction of the M phase during the $\gamma\rightarrow$M transformation:

$$X_M = 1-\exp\overline{V}\varphi[\frac{\partial \Delta G_V^{\gamma\to M}}{\partial T}(M_s - T_q)] \tag{13}$$

3 COMPUTATIONAL RESULTS AND ANALYSIS

3.1 Impact Of Cooling Rate On Γ → Mtransformation

Fig. 3 shows the relation between the volume fraction (XM) of martensite and the temperature at different cooling rates. From the figure we see that the martensite starts to transform at about 410℃ at different cooling rates. This indicates that cooling rate almost has no impacts on the temperature Ms of martensitic transformation. It can be seen from the shape of the curve that the transformation speed is relatively low at the initial stage (XM<10%) as well as the final stage (XM>90%) of the martensitic transformation, while is the highest at the middle stage.

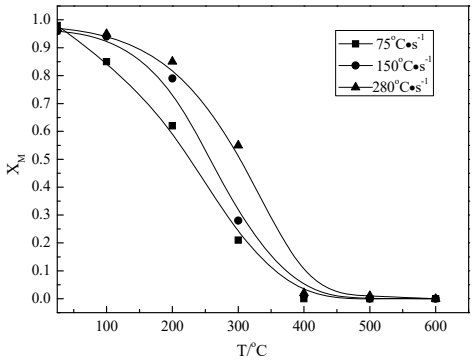
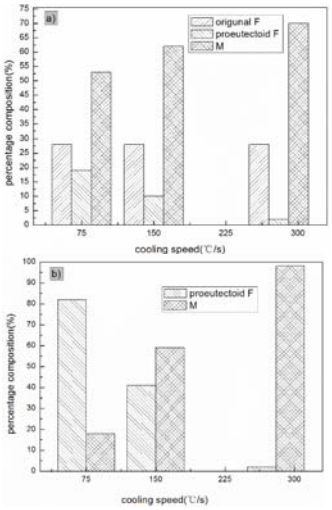


Figure 1 Relationship curve for volume fraction of martensitic transformation and temperature

The shape of the curve shows some difference during the transformation at different cooling rates. When the martensite transforms at the cooling rate of 75 ℃ /s, the volume fraction XM has a approximate relation with temperature T; when the martensite transforms at a higher cooling rate, the curve consists of, obviously, two parts, indicating that the amount of martensitic transformation evenly increases as the temperature decreases at a low cooling rate, while the formation of martensite is not increasing as the temperature decreases when the cooling rate is relatively high. This is mainly because of the internal stress generated by specific volume difference between the new martensite and the parent austenite as well as by the contraction effect as the cooling rate increases, resulting in a great deal of plastic deformation of martensite and austenite. Such deformation has a direct impact on the formation of martensite.

3.2 Volume Fraction Of Transformation

Here we calculate, respectively, the volume fractions in the two-phase region (austenite+ferrite) and the high-temperature single phase (austenite) of the mild steel at different cooling rates.



a) The microstructure at room temperature after the two-phase (F+A) region being cooled, b)The microstructure at room temperature after the A

phase being cooled

Figure 2 Volume fraction at different cooling rate

It can be seen from the histogram that the volume fraction of ferrite decreases gradually as the cooling rate increases, no matter the initial state is the high-temperature austenite phase or the two-phase. This is because the increasing of the cooling rate can reduce the temperature of ferritic transformation and can postpone the transformation from austenite to ferrite. Meanwhile, carbon atoms in the new formed ferrite do not have enough time to diffuse into the parent phase austenite due to the rapid cooling rate, resulting in the low carbon content of the austenite that cannot meet the condition for cementite precipitation. When the cooling temperature reaches to Ms, the martensitic transformation begins to start in the rest parent phase austenite, and the volume fraction of the martensite increases dramatically with the increasing of the cooling rate. When the cooling rate reaches at 280℃/s, almost all the austenite has transformed into martensite.

Fig. 5 shows microstructure of the cold-rolled mild steel (with 84.6% of deformation) heated at the same rated but cooled at different rates. The microstructure is obtained from the simulation on the Gleeble-3500 platform. From the figure we see that not only the amount of martensitic transformation increases but also the morphology of the formed lath martensite changes with the increasing of the cooling rate.

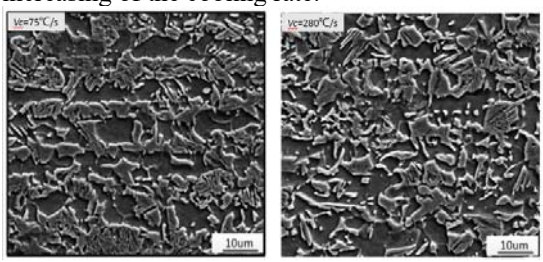


Figure 3 Microstructure in different cooling rate

Large lath martensites are formed at low cooling rate, and between these lathes are tiny ferrolites. This is because a low cooling rate will result in eutectoid transformation of austenite. And, because the cooling rate is much faster than the the sizes of the annealing rate, eutectoid ferrite grains are very small (about 5μm). The increasing of the cooling rate can resulted in small and intensive lath martensites. Between the lath martensites there are almost no eutectoid ferrites, for the cooling rate at this moment is close to the critical rate at which the eutectoid transformation occurs in the mild steel, and it is therefore not easy to generate ferritic transformation.

4 CONCLUSIONS

1) Martensite can be formed in mild steel if cooled by quenching. Simulation of martensitic transformation has been conducted based on the relevant thermodynamics and kinetics theories. Cooling rate almost has no impact on the temperature Ms of martensitic transformation. And, the transformation speed is relatively low during both the initial and final stage but is the highest during the middle stage.

2) Simulations on martensitic transformation in the A+F phase and the single A phase have been carried out at different cooling rates (by quenching). The volume fraction of martensite increases sharply with the increasing of the cooling rate. When the cooling rate reaches at 280℃/s, almost all the austenite has transformed into martensite.

3) Experimental analysis shows that: large lath martensites are formed at low cooling rate; between these lathes are tiny ferrolites; the increasing of the cooling rate can resulted in small and intensive lath martensites, and; between the lath martensites there are almost no eutectoid ferrites.

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Design of the Automatic Nondestructive Hair Collection Device for Wild Animals

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Abstract: In this paper various ways of collecting hair of wild animals were researched. An automatic nondestructive hair collection device was designed because of the research on DNA of wild animals. In order to collect wild animals' hair we use sensors, MCU, motors and other components to design a set of system including the function of detecting, automatic collecting, recycling and storing. In order to achieve the purpose of non-destructive, efficient and accurate collection of wild animals' hair. This method has the initiative. It upgrade and improve the traditional one.

The hair collector designed to be a sphere with barbed wire. The hair pickup connected to the recycling mechanism with a high-strength rope.Servo drives the swing arm rotate to release the rod which fix the spring. Force of the spring pushes the piston to launch the hair pickup. Drawing back the collecting ball immediately when finish the collection. We conducted experiments on large canine. The hair we collected include some with hair follicles. Verified that the device can meet the requirements. The hair collected by the device can be used to extract DNA of wild animals and establish genetic resource library. It has great significance for researching and conservating endangered wild species.

Key words: hair of wild animal; automatic collection; nondestructive; spring launch; MCU

1. INTRODUCTION

In the process of the study of wildlife or endangered species is often needed to establish a species gene repository for using and sharing in follow-up study of the species DNA information. There are many methods to get wild animals' genetic information. For example, animals can be directly captured to collect blood, hair and tissue. People can also accomplish collect work with a well-designed trap and device. Finally extracted from the collected samples to genetic information. Nowadays there are three methods to collect animals' hair:(1) Extracting hair from feces of animal.(2)Placing the barbed wire in somewhere wildlife often go through or using bait to lure the animals go through barbed wire. Then scraped hair with spikes.(3) Collecting hair with collection device. Hanging the hair collection device on the tree trunk and use bait to lure the animals into the trap.

From the barbed wire to the collection device the principle is similar. But both of them cannot ensure the purity of the hair sample and not able to save it. That reduces the quality of samples.The automatic nondestructive hair collection device detects the proximity of wildlife with sensors. Then launch the hair pickup to hit animals and collect hair. The device stores the pickup to avoid damage. The collection has been improved and perfected device based on the principle of traditional hair collection device.It solves the problems of traditional hair collection device to a certain extent. The collection device is automatic and for a single object. The hair sample collected has high purity and can be well-stored.

2. MATERIALS AND METHODS

2.1 Launch Module

2.1.1 High pressure pneumatic launch

This method modeled on the principle of dumped lifesaving device. Instantaneous release the high pressure gas within the high-pressure gas cylinder to push it fly straight ahead. First we use a large high-pressure gas cylinder to aerated a small high-pressure gas cylinder. Stop aeration when reach a certain pressure. After that we pull out the insurance and pull the trigger to launch. The air in the high-pressure gas cylinder eject backward to push it fly straight ahead.

The advantages of this method are the easily accessible gas and the high-speed launch. But the big noise make it more possible to alert animals. Besides, the high-pressure gas cylinder is heavy and it may hurt animal badly. And the high pressure gas cylinders dangerous good so it is likely to explode.

2.1.2 Friction wheels launch

This method modeled on the tennis transmitter. When the spherical hair pickup go between the two friction wheels, which rotate in the opposite direction, the sphere will be extruded and friction. Then the hair pickup will be launched with rotation.

The advantages of this method is low noise. But it has more restrictions to the hair pickup's surface and shape. It requires flexibility and smooth surface. Otherwise, it will cause greater damage to friction wheels and motors.

2.1.3 Spring launch

Launch mechanism main body is a launch tube made of a 50cm long, diameter 8cm PVC tube. Piston and spring combination mechanism is in the tube. The launch tube's tail has a 10cm long rod which holds the spring when it is under pressure. Servo is equipped at the end of launch tube. A drop-shaped metal arm is equipped on the servo. The base is made

of 1mm thick stainless steel alloy which is able to withstand exposure to rain and the wild harsh environment.

The launch speed of this scheme is high and the noise is low. Moreover, it has no restrictions to the hair pickup's surface and shape and it is not easy to damage because of the strong mechanical structure.

In conclusion we use the scheme of spring launch.

2.2 Retrieve module

A wheel inside the base of the device could be seen in fig.1. The wheel with an intermediate diameter of 32mm and an end-to-end diameter of 49mm was driven by a brushless motor. The small part of intermediate diameter of the wheel was used to twine the string to connect pickup. In case the string was snapped in the process of retrieve, a nylon string with high tensile strength was used. The other end of string on the pickup was fixed on the wheel. Motor drove the wheel, and string was coiled on the wheel by its rotation. The pickup was retrieved into the base to conserve fur.

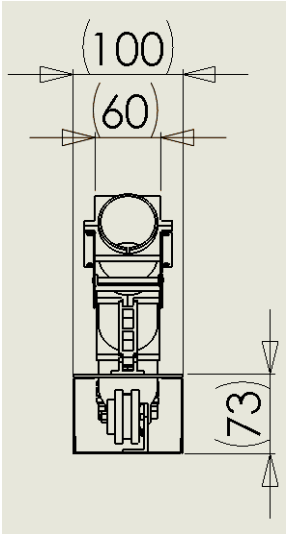

Fig.1 Front view of device

3 Program design

4. RESULTS AND DISCUSSION

We collected for 12 times in the experiment and all of them hit targets. Fur was collected for 9 times. It shows that the pickup collected the most of fur when animals moved directly towards the launch device. The reason might be that pickup adhered more tightly with fur when there was a relative motion. When animals moved into collection area from the flank, closer the animals were, the more fur was collected, and further the animals were, the less fur was collected. The reason might be that the distance decelerated the pickup, and fur cannot be adhered tightly. When the animals were small, the collection was of low accuracy. Because the ultrasonic wave sensor demanded bigger reflection area, small animals may not trigger the sensor. When the animals owned a bigger shape, the pickup could hit the targets accurately and collected fur. The experiment device could achieve the goal of design.

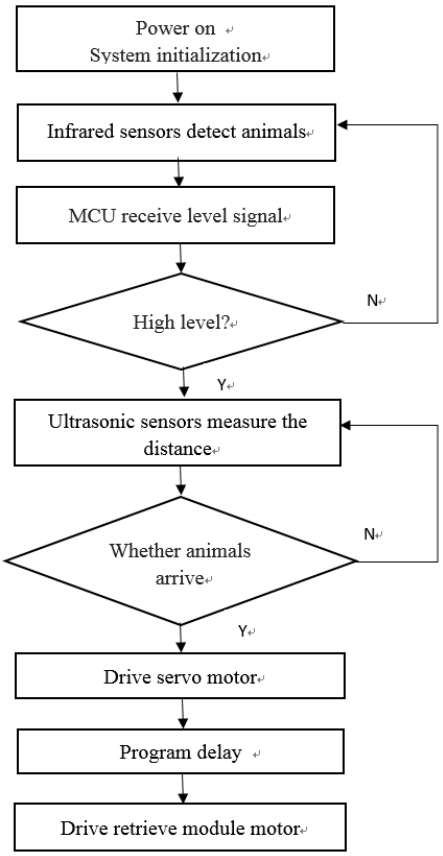

Fig.2 Program design flowchart

5. CONCLUSION

Nowadays, the protection of wild animals has been more urgent, and it's a necessary rescue measure to build a gene repository of endangered animals. Smart wild animals fur collection device is going to be an essential equipment for wild animals protection. It achieves a more efficient and accurate fur collection, and lows fur damage in some degree, and builds a good foundation for the following research. It was proved in the article that the automatic non-damage wild animals fur collection device was able to collect animals fur efficiently, and fur could be conserve well. It could satisfy the demand of animals protection. The device has some advantages which traditional fur collection devices don't have, such as automation, fur conservation and high accuracy. However, the pickup of the device isn't able to launch and retrieve continuously, which limits the amount of collection. It requires further research to solve the problem.

6. ACKNOWLEDGEMENTS

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Based on the Biomechanics of Shot Put Motion Process Simulation and Prediction Model of Equation

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Abstract: In view of the shot put trajectory is analyzed with mechanics, and to promote the shot put to speed and performance, and shot put the best Angle of mathematical optimization model is set up, to provide reasonable Suggestions for project training, providing theoretical basis for the coaches and athletes. In the shot put game throwing distance is the final research goal, this paper use the kinematics study the shot put movement process, and then analyzed the data of the previous Olympic shot put project to get the shot put performance simulation diagram, prediction model based on the results. Finally, the shot put athletes give reasonable Suggestions.
Keywords: Kinematics model, Shot put technique, biological mechanics

1. INTRODUCTION

The shot put movement has a long history, is an ancient sport, and also is the modern Olympic Games important field events. The origin of the shot put movement can be traced back to the original ancient society. People in ancient times in the face of harsh environment and low productivity, in order to thrive, will have a certain ability of sports. Not only have to run fast, across all sorts of obstacles to track its prey, and use simple objects such as stone to hunt for food. By slavery, human society has the war, in order to improve the army's combat effectiveness, there has been throwing rocks in military training of training and competition. In 1896, the first modern Olympic Games held in Athens, Greece, shot put is listed as a man. Shot put technique since produce experience about the development of more than six hundred years. The original technology was in situ push and side to push the ball leapfrog[1-4]. While the rapid development of sports technology began from the first modern Olympic Games in modern times, has experienced three stages: stage of lateral slide of shot put; backward slide of shot put stage; Opposite to the rotational shot put technique challenge stage. The modern shot put complete technology including hand ball, ball, and slide or rotate, maintain body balance and the last five technical links. Technology is complex, difficult and requires a tall figure, strong explosive force, and the whole body motion coordination ability [5-8].

Current research combining mechanics and kinematics of shot put project is one of the hot spots. There are quite a few scholars made in-depth research, such as li jingyi made "active service in our country excellent men's shot put athletes' slide of the kinematics research". Them through the method of 3 d kinematics analysis to our country current outstanding eight slide of shot put athletes technology study found that players are widespread in China long slide, big push to the right leg stretching is not positive, seed, his right leg in the process of slide is not positive, beyond the instrument disadvantages such result is bad, should be improved in the later training. Wen-xue Yang made such as "the world's best men's shot put athletes throwing biomechanics analysis". They provided by parsing technology of athletes biomechanical parameters of world elite male shot put athletes, the athlete's technical comparison, analysis of the slide and rotational shot put technique and the differences between different types of spinning technology. Mainly study the shot put itself and the acceleration in the body, thus it is concluded that the athletes and the shot put the system acceleration to the stage to the shot put final action sequence of process variation characteristics, as to provide theoretical basis for high level shot-putter technology training [9].

In this paper, based on the kinematics and mechanics was used to study the shot put movement process, and then analyzed the data of the previous Olympic shot put project to get the shot put performance simulation diagram, prediction model based on the results.

2. MOVEMENT PROCESS RESEARCH

By observing shot movement process, the paper divides the process into two phases: push process and shot flight process in the air. Due to shot its own mass is big enough, the paper ignores air resistance to it, and then respectively researches on the two process.

2.1 Push process

In the process shot state is during acceleration, assume that accelerated speed is fixed as a, in pushing process, it pushes an arm length of l, ball out of hand moment speed is v, set shot acceleration time is t_1, according to kinematics, it can get:

$$l = \frac{1}{2}at_1^2 \quad (1)$$

$$v = at_1 \quad (2)$$

Simultaneous formula(1)、(2), it can get: $v = \sqrt{2al}$

2.2 Air flight process

Shot flight process state in the air is as Figure 1 show, the paper divides the process into two parts that are respectively shot moving from release point to highest point and moving from highest point to landing point.

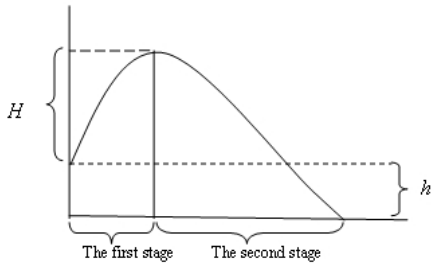

Figure 1 Air flight process

Assume that shot drop point and release point distance is s, when shot rising height is H, spend time is t_2, time for shot falling from highest point to ground is t_3, shot air movement total time is T .By Newton kinematical formula, it can get:

Phase that shot moves from release point to highest point: decompose speed v into horizontal direction and vertical direction speed component that are respectively v_x and v_y , and $v_x = v\cos\theta$, $v_y = v\sin\theta$, as Figure 2.

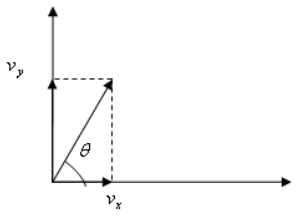

Figure 2 Speed decomposition

Drop point and release point distance $s = v_x \cdot T$, shot total time in the air $T = t_2 + t_3$, shot rises to highest time $t_2 = \frac{v_y}{g}$.

From shot highest point to landing point phase: $t_3 = \sqrt{\frac{v_y^2}{g^2} + \frac{2h}{g}}$, for t_3, because shot putters' heights are generally within $1.8m$, so $\frac{2h}{g} \le 0.36$, they have smaller increment to t_3 , so $t_3 = \sqrt{\frac{v_y^2}{g^2} + \frac{2h}{g}} \approx \frac{v_y}{g}$ .Therefore $t_2 = t_3 = \frac{v_y}{g}$, it solves $s = \frac{v^2}{g} \cdot \sin 2\theta$. So when shot running speed to a certain degree, when $\theta = 45^\circ$, s is maximum.

For result, it makes suggestions: in shot event, to get relative excellent performance, according to above conclusion, we can see distance $s = \frac{v^2}{g} \cdot \sin 2\theta$, therefore to get excellent performance in shot event, it should change v and θ .It makes following suggestions: control release speed v to be enough big, it needs to promote accelerated speed sizes in accelerated speed process; For hands throwing moment ball throwing direction and horizontal direction included angle θ keeps around 45 degree.

3. PERFORMANCE PREDICTION MODEL

3.1 Model establishment

In 1838, Belgium biologist Pierre Francois Verhulst presented retardant growth model. Lots of different surfaces things after making reasonable simplifying hypothesis according to their internal functions construct retardant growth models. Therefore it is widely applied into mathematics, biology, economics and management as well as others multiple fields, it includes continuous and scatter two forms.

Considering competition environment, human body physical ability, competitiveness and other factors retardant effects on sports performance, the paper makes use of retardant growth model to make analysis and prediction on shot performance. Retardant effects reflect in shot event growth rate r influences, let r diminish with performance x increasing. If represent r as x function $r(x)$.

$$\frac{dx}{dt} = r(x)x(t), x(0) = x_0 \quad (3)$$

Assumption to $r(x)$ is, set $r(x)$ as x linear function, that is :

$$r(x) = r - sx \quad (r > 0, s > 0) \quad (4)$$

Given due to people body physical ability extreme and athletes' physical quality, growth rate x_m, when $x = x_m$, performance will not grow any more that growth rate $r(x_m) = 0$, input formula(4), it gets $s = \frac{r}{x_m}$, so formula(4)is:

$$r(x) = r\left(1 - \frac{x}{x_m}\right) \tag{5}$$

Input(5)into(3)equation, it gets:

$$\begin{cases} \frac{dx}{dt} = rx\left(1 - \frac{x}{x_m}\right) \\ x(0) = x_0 \end{cases} \tag{6}$$

Solve equation(6), it can get:

$$x(t) = \frac{x_m}{1 + \left(\frac{x_m}{x_0} - 1\right)e^{-rt}} \tag{7}$$

Expression(7)is retardant growth model standard equation.

3.2 Model solution

Retardant growth model is :

$$x(t) = \frac{x_m}{1 + \left(\frac{x_m}{x_0} - 1\right)e^{-rt}}$$

Take reciprocal on equality two sides, it gets : $\frac{1}{x(t)} = \frac{1 + \left(\frac{x_m}{x_0}\right)e^{-rt}}{x_m}$,

That : $\frac{1}{x(t)} = \frac{1}{x_m} + \left(\frac{1}{x_0} - \frac{1}{x_m}\right)e^{-rt}$

In shot event sports state change process, it makes statistics shot performance data from first Olympic Games in 1896 to London Olympic Games in 2012; list is as following Table 1.

Table 1 Each session summer Olympic Games shot performance statistics table

Vintage/Year	Gold medal performance/m	Silver medal performance/m	Bronze medal performance/m
1896	11.22	11.20	10.36
1900	14.10	12.85	12.37
1904	14.81	14.40	13.37
1908	14.21	13.62	13.18
1912	15.34	15.25	13.93
1920	14.81	14.15	14.15
1924	14.99	14.89	14.64
1928	15.87	15.75	15.72
1932	16.00	15.67	15.61
1936	16.20	16.12	15.66
1948	17.12	16.68	16.42
1952	17.41	17.39	17.06
1956	18.57	18.18	17.65
1960	19.68	19.11	19.01
1964	20.33	20.20	19.39
1968	20.54	20.12	20.09
1972	21.18	21.17	21.14
1976	21.05	21.03	21.00
1980	21.35	21.08	21.06
1984	21.26	21.09	20.97
1988	22.47	22.39	21.99
1992	21.70	20.96	20.94
1996	21.62	20.79	20.75
2000	21.29	21.21	21.20
2004	21.16	21.16	21.07
2008	21.51	21.09	21.04
2012	21.89	21.59	21.23

Use Matlab drawing pictures, mark out each session summer Olympic Games shot champions performance roughly trends, figure is as following Figure 3.

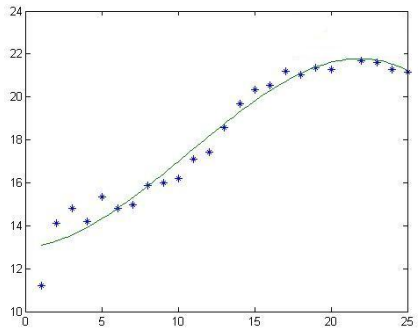

Figure 3 Shot performance trend figure

By above Figure 3, it finds Olympic Games shot performance will appear a rapid growing logarithmic phase, when arriving at maximum growth rate, after that due to human body own physical ability restriction conditions, let growth rate gradually reduce, shot throwing distance will slowly growing and finally arrives at maximum value's stable period, growth curve shows S type. Olympic Games shot event performance growth situation can analogical to retardant growth model, hereby it adopts retardant model predicting Olympic Games shot event performances.

To predict previous Olympic summer Games shot performance, it consults five years' Olympic summer Games champions' performance from 1952 to 1968, data is as Table 2.

Table 2 Olympic Summer Games champions performance from 1952 to 1968

Years	1952	1956	1960	1964	1968
Gold medal performance	17.41	18.57	19.68	20.33	20.54

Regard year 1952 as starting time, that $t = 0$, year 1968 is ending time, that $t = 4$ make non-linear

fitting with above table data, apply Matlab program, it gets relative parameters, that $r = 0.0888$ and $x_m = 22.5954$.

Input (7), it gets :

$$x(t) = \frac{x_m}{1 + \left(\frac{x_m}{x_0} - 1\right)e^{-rt}} = \frac{22.5954}{1 + 0.2978e^{-0.0888t}} \quad (8)$$

By above formula, it solves year 1972 ~1988 predicted values as Table 3.

Table 3: Year 1972 ~1988 Olympic Games performance predicted value

Year	1972	1976	1980	1984	1988
True value	21.18	21.05	21.35	21.26	22.47
Predicted value	21.138	20.972	21.222	21.119	22.304
Error	0.042	0.078	0.128	0.141	0.166

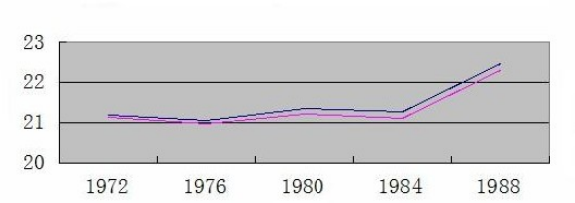

Figure 4 Year 1988 ~2004 Olympic Games shot predicted value and true value comparison

By Figure 4, it can see assume that Olympic Games performance growth in retardant model, predicted value gets relative closer to true value, error is smaller.

4. CONCLUSIONS

The paper carries out analysis of shot movement process and shot movement data by kinematics, mechanics and retardant growth model. At first, according to shot movement process state differences, divide it into push process and air flight process two phases. Control release speed to be big enough, it needs to promote accelerate speed sizes in acceleration process. By statistics Olympic Games shot performance data from year 1896 to 2012, use Matlab drawing out performance roughly trend, it concludes: Olympic Games shot event performance growth situation can analogous to retardant growth model, hereby it adopts retardant model predicting Olympic Games shot event performance. By establishing above model, it presents relative reasonable suggestions with regard to how to let shot putters get good results in competition: at ordinary training, athletes should strengthen physical quality and psychological quality training; control optimal release angle, athlete should master correct exertion order; make more arm strength training

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The Influence of Sediment Concentration on Water Consumption in the high Lift and Rundle Irrigation Pumping Station

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Abstract: According to field investigation and the pumping station operation test data for many years, through the calculation of sediment concentration on high lift cascade numerical station and analyzed the influence of water consumption, results show that the water with high of sands contained stream flow to the impact on the energy consumption of pumping stations water are quite different. Sets grit chamber in pump station system is proposed to reduce the sediment concentration, improving the efficiency of the pumping station.
Keywords: pumping station, forebay, sediment concentration, numerical simulation, water consumption

1. THE INFLUENCE OF SEDIMENT CONTENT ON WATER CONSUMPTION

Belongs to the little rain in arid regions, the western China to effectively solve the dry lack water, drinking water difficulties, long-term deserted areas suitable for farming land, improve the lives of these areas, ecological environment, prevent south desert, successively in Gansu, Ningxia, Shanxi and other parts of the country built some big high lift water pumping irrigation works. Rundle water get from theYellow River.

Qinchuan Jingtai electric power pumping irrigation project of Gansu province has 43 large step stations. About 180 km from Lanzhou, the Yellow River in the east, Tengger desert to the north, along the Ming Great Wall from east to west across Jingtai, Gulang two counties, extend to Minqin county. From pumping station running early before there is serious sedimentation pool (see Fig. 1), part of the pumping station forebay of silt sediment deposition reached the forebay more than half of the total capacity, part of the pump inlet blocked by sedimentation, the serious influence of the pumping unit into the water regime and falling unit vibration and efficiency substantially.

In many design and modification of large pumping stations, in order to obtain good water flow state of forebay, often adopt the method of hydraulic model test of forebay to decorate a form and size, rectification measures, sediment prevention measures, studies the operation scheme, determine the optimal design scheme for the pumping stations to provide theoretical basis and technical support.

After many years' hydrologic observation records statistics, in the section of the Yellow River electric irrigation district, the annual average sediment concentration up to 30 kg/m3, the maximum sediment concentration of 382 kg/m3. Because the water contains a lot of sediment, in the process of pumping water, sediment for pump station operation efficiency, abrasion, water power consumption of the unit has a different effect. Below to view the electric irrigation district as an example calculation the influence of sediment on water consumption. Forward water forebay Lateral water forebay

Figure 1 Forebay sedimentation

1.1 Formulas

Efficiency η is the effective power of the pump and

the ratio of shaft power. It marked the pump working performance of the high and low, is an important technical and economic indexes of the pump, usually expressed in percentage. Its expression is,

$$\eta = \frac{N_e}{N} \times 100\% \quad (1)$$

Type N_e is the effective power, N for shaft power. Power refers to the water pump in the work done per unit time. In the pump work, its size mainly depends on the capacity and head of the pump, it is a major measure of water pump working ability, unit is kW.

Effective power N_e refers to the actual power gained by the water flow through the pump, also known as the output power of the pump. Energy gained by the pump head is a unit of weight liquid, liquid volume flow rate per unit time is through the pump, the effective power of ,

$$N_e = \gamma QH \quad (kW) \quad (2)$$

Type γ is the water in the bulk density, kN/m^3. Q for traffic, m^3/s. H for the pump head, m.

Shaft power is required when the pump work plus N power, it is by the engine to the pump shaft, therefore calls shaft power, also can call it the input power of the pump.

1.2 Calculation Example

Jingtai electric power pumping irrigation district pumping station project design flow Q a mean of 14.2 m^3/s, the average total head H is 471.375 m. Irrigation water intake of water in the river sediment concentration of 30 kg/ m^3, so the density of Jingtai electric power pumping irrigation district water is kg/ m^3, by type $\gamma = \rho g$, γ is 10.094 kN/ m^3.

By statistics, pumping station running days to an average of 168 days, η = 76% average water pump efficiency. By formula (2) the energy consumption of pumping water to calculate.

Is calculated in the effective power $N_e = \gamma QH$, N_e = 67 564.4 (kW).

Average total power consumption when the irrigation water is,

67 564.4×24×168=272 419 827.5(kW·h)

67 564.4×24×168=272 419 827.5(kW·h)

In order to reduce energy costs, according to the formula (2), the need to reduce the water density. By type $\gamma = \rho g$, lower must reduce water density ρ, which reduced the water sediment concentration.

2. ADDING SAND BASIN TO REDUCE ENERGY CONSUMPTION

The high sediment concentration in the Yellow River pumping station system put forward the measure of adding sand basin, to reduce the sediment concentration in the water conveyance system. Add sand basin, can effectively reduce the sediment concentration of water in the water conveyance system, improve the efficiency of the operation of the pumping station, water saving energy consumption, reduce maintenance costs.

To view the first phase and the second phase of Jingtai electric power pumping irrigation district, for example, this research puts forward two kinds of sand basin arrangement: (1) sand basin between the water and a pumping station, the river - channel - pool - station form. Set up a primary low-lift pumping station first 10-15 meters (head), and then set up the sand basin, the river - station - pool - station form. The concrete working principle of sand basin is as follows.

2.1 River-Channel-Pool-Station Form

(1)Muddy water became clear water: the channel of water diversion from the Yellow River water to the sand basin precipitation, and then by the extract after precipitation of water pumping station to high lift irrigation water step by step.

(2) Setting basin dredging, after a certain time of running, must fill in the settling basin has large amounts of sediment, settling basin sedimentation cleaning mainly through river drainage into the Yellow River, river canal slope needs to meet the requirements of the new sediment. Flushing water diversion channels is quoted from the Yellow River water, the water from channel into the pool open drainage sand sluicing gates, will the silt sedimentation in the pool by desilting canal ran out. As shown in Fig. 2.

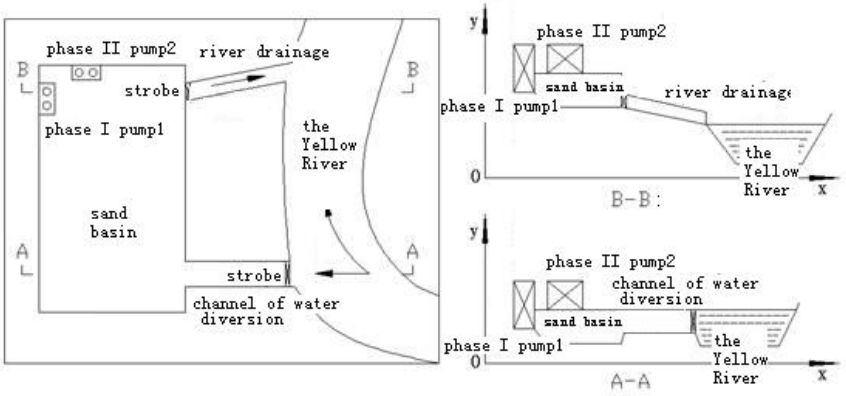

Figure 2 River - channel - pool - station form

2.2 River-Station-Pool-Station Form

(1)Muddy water is water from a primary low-lift pumping station (lift 10 to 15 meters) from the Yellow River water pump to the sand basin, after precipitation by muddy water changes to water, again by cascade pumping stations pumping water pump to the high lift irrigation area.

(2) Setting basin dredging, deposition of sediment in the settling basin is mainly through the river channel to the Yellow River, river canal slope needs to meet the requirements of the new sediment. Through primary low-lift pumping station after extraction of the Yellow River water pump to the pool, open drainage flushing sluice, the silt sedimentation in the pool through sand flushing canal ran out. As shown in Fig. 3.

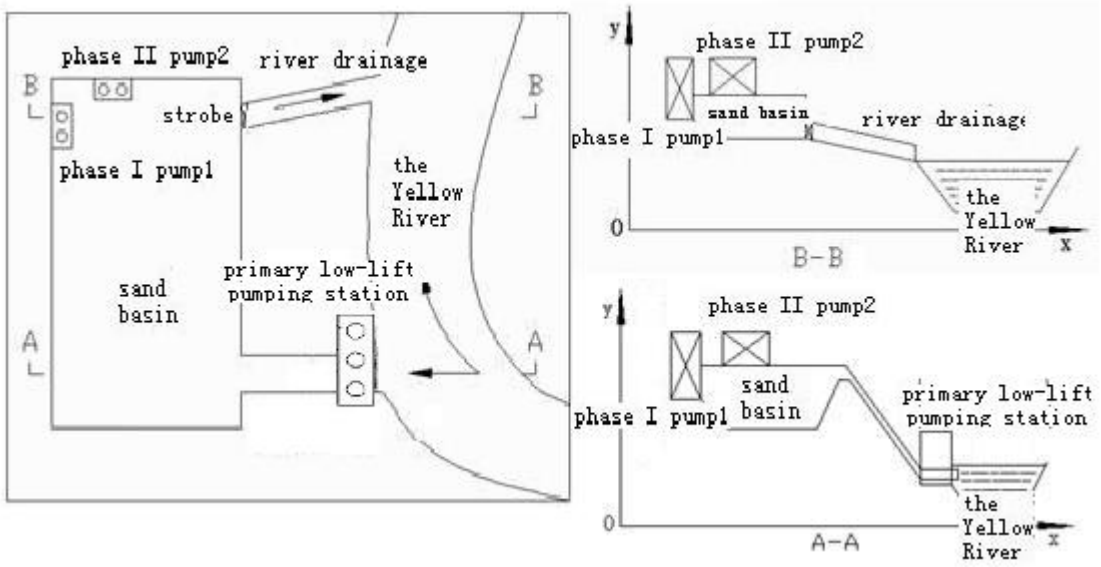

Figure 3 River - station - pool - station form

Through the analysis of the hydraulic test, river - channel - pool - station form higher requirements for the geographical position, topography, it must ensure that the diversion channels and desilting canal section of the Yellow River has certain difference between the sediment discharged to make. Desilting effect is not obvious, after many experiments, ρdecreased to 1.02×10^3 kg/ m^3, γ is 9.996 kN/ m^3.River - form - pool - stand for requiring less terrain geographic conditions, desilting effect is good, through many times test statistics, decreased to 1.01 x 103 kg/m3, 7, 9 is 9.898 kN/m3. River - station - pool - station form requiring less terrain geographic conditions, desilting effect is better, after many experiments, ρ decreased to 1.01×10^3 kg/ m^3, γ is 9.898 kN/ m^3.

2.3 Different Sand Basin Water Consumption

(1)River - channel - pool - station form

γ = 9.996 kN/ m^3, the effective power $N_e=\gamma QH$, N_e = 66 908.48（kW）.

Pump station running days to an average of 168 days. Average total power consumption when the irrigation water is,

66 908.48×24×168=269 774 974.8(kW·h)

(2) River - station - pool - station form

γ = 9. 898 kN/ m^3, the effective power $N_e=\gamma QH$, N_e = 66 252.51（kW）.

Pump station running days to an average of 168 days. Average total power consumption when the irrigation water is,

66252.51×24×168=267 130 122.1(kW·h)

By transmission of clear water and muddy water losing energy consumption calculation, it can be seen that lose muddy water（γ = 10.094 kN/ m^3）more than clear water（γ = 9.996 kN/ m^3 ； γ = 9.898 kN/ m^3）consumption are,

272 419 827.5－269 774 974.8 =2 644 852.7(kW·h)；

272 419 827.5－267 130 122.1 =5 289 705.4(kW·h)。

According to the actual local society electricity price of Jingtai electric irrigation district is 0.399 Yuan/(°), can save cost, respectively a year,

River - channel - pool - station form

2 644 852.7×0.399=1.055（million Yuan）,

River - station - pool - station form

5 289 705.4×0.399=2.111（million Yuan）.

If consider the water pump efficiency, η = 76% a year can save cost 1.388 million Yuan and 2.7776 million Yuan respectively, as shown in table 1.

Table 1 Energy consumption of water transmission

Type of sand basin	Power consumption of conveying clean water / kW·h	Power consumption of conveying muddy water / kW·h	Save electricity / kW·h	Save cost /million Yuan	
				In theory	Actually（η =76%）
River -	269 774 974.8	272 419 827.5	2 644 852.7	1.055	1.388

channel - pool - station form					
River - station - pool - station form	267 130 122.1	272 419 827.5	5 289 705.4	2.11 1	2.7776

Through the above analysis shows that the influence of sediment on the unit operation efficiency and energy consumption is very serious, sediment concentration, reducing irrigation water can not only save a lot of energy costs, at the same time can reduce the sediment particle abrasion of water pump, cutting unit maintenance costs, prolong the use fixed number of year.

3. CONCLUSION

(1)For sediment concentration of high-lift cascade numerical standing water comprehensive analysis of the influence of energy consumption, it is concluded that high sediment flow has a great influence on the energy consumption of water. Research shows, reduced water sediment concentration can effectively reduce water energy costs.

(2)To add sand basin in order to reduce water sediment concentration engineering measures can not only reduce the energy consumption of water, water saving energy costs, and can also reduce sediment particle abrasion of water pump, reduce unit maintenance costs, prolong the use fixed number of year. The same has been built or to be built engineering has important practical significance.

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Lateral Water Pumping Station Forebay of Jingtai Electric Power Irrigation District Flow State Numerical Simulation and Preventing Silt Research

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Abstract: with a standard $k-\varepsilon$ two equation turbulence model for calculating method, mathematical model is set up, the numerical simulation of the flow regime of lateral water pumping station forebay of Jingtai electric power irrigation district, the speed of the simulation flow chart shows that the lateral water pumping station forebay of sediment deposition in the main unit and the flow regime, open composite states and the forebay structure, and puts forward some rationalization suggestions for improvement.
Keywords: lateral water pumping station forebay, standard $k-\varepsilon$ two equation turbulence model, numerical simulation, preventing silt.

1. MATHEMATICAL MODEL

Belongs to the little rain in arid regions, the western China to effectively solve the dry lack water, drinking water difficulties, long-term deserted areas suitable for farming land, improve the lives of these areas, ecological environment, prevent south desert, successively in Gansu, Ningxia, Shanxi and other parts of the country built some big high lift water pumping irrigation works. These projects become the arid regions of west people rich engineering, play a huge economic benefit, social benefit and ecological benefit.

Qinchuan Jingtai electric power pumping irrigation project of Gansu province is divided into phase I and phase II project. The design flow rate of phase I is 10.4 m3/s, the average total head is 419 m. The design discharge of phase II is 18 m3/s, the average total head is 523.75 m. The pumping irrigation project has large cascade numerical station 43, installed capacity of 242000 kW, maximum head for 713 m. The water pumping water to water, water sediment concentration, up to 382 kg/ m3, built in the operation of most of the pumping station forebay appear the phenomenon of large amounts of sediment deposition and the project of water increases, water pump efficiency, reduce energy consumption, which seriously affected the project run efficiently, makes the pumping station energy consumption increased significantly, as one of the main factors that restricted irrigation engineering work efficiency.

Therefore, Qinchuan Jingtai electric power pumping irrigation project large-scale irrigation district pumping station forebay, the sediment deposition mechanism, deposition prevention technology research has both improving existing engineering structures, the realistic meaning of optimizing operation combination and guidance for establishing engineering to the design theory of sedimentation value. Using computer technology to the water before pumping station stream flow simulation, to study before the pond sediment deposition mechanism, improve the efficiency of pump station of the device, reduce the energy consumption of pumping stations, plays an important role. At the same time, it will greatly reduce the cost of pumping station model test, which has extensive application value.

1.1 The Governing Equation

Fluid movement to follow the law of conservation of mass, momentum conservation law, the law of conservation of energy the three laws of physics. The mathematical description of fluid motion constitutes the basic equations of fluid dynamics. [1] This topic is the study of the constant temperature of fluid, so the energy equation is satisfied automatically, can not consider the impact in the calculation.

Fluid flow of pumping station forebay in line with the incompressible flow field of the law of conservation of mass, conservation of mass equation is also called the continuous equation, the mathematical expression,

$$\frac{\partial u_i}{\partial x_i} = 0 \tag{1}$$

The law of conservation of momentum equation of pumping station forebay mathematical expression is,

$$\frac{\partial}{\partial t}(\rho u_i) + \frac{\partial}{\partial x_j}(\rho u_i u_j) = -\frac{\partial \rho}{\partial x_i} + \frac{\partial}{\partial x_j}(\mu \frac{\partial u_i}{\partial x_j} - \rho \overline{u_i' u_j'}) + S_i \tag{2}$$

Type u_i , u_j , the flow rate of the said in all directions. x_i , x_j , said each axis. S_i is the source term. Feet i, j values of 1, 2, 3 indicates three space coordinates.

1.2 Standard $k-\varepsilon$ Tow Equation Turbulence Model

Calculation of turbulent flow the key is how to determine the turbulent viscosity μ_t .Turbulence model is μ_t with both turbulence parameters are given. According to determine the number of differential equation μ_t , the turbulence model can be divided into zero equation model, a equation model and two equations model, etc. In the engineering calculation of turbulence, the most widely used $k-\varepsilon$ two equation model.

Based on the equation of turbulent kinetic energy k , introduce another about the turbulent dissipation rate equations of ε , formed two equation model, referred to as a standard $k-\varepsilon$ models. In the model, said ε is defined as the turbulent dissipation rate,

$$\varepsilon = \frac{\mu}{\rho}\overline{(\frac{\partial u_i}{\partial x_k})(\frac{\partial u_i}{\partial x_k})} \qquad (3)$$

Turbulent viscosity μ_t can be presented as a function of k and ε ,

$$\mu_t = \rho C_u \frac{k^2}{\varepsilon} \qquad (4)$$

In the standard model of $k-\varepsilon$, k and ε are the two basic unknown quantity, the k equations and ε equations are,

$$\frac{\partial(\rho k)}{\partial t}+\frac{\partial(\rho\varepsilon u_i)}{\partial x_i}=\frac{\partial}{\partial x_j}\left[\left(\mu+\frac{\mu_t}{\sigma_\varepsilon}\right)\frac{\partial k}{\partial x_j}\right]+G_k-\rho\varepsilon \qquad (5)$$

$$\frac{\partial(\rho\varepsilon)}{\partial t}+\frac{\partial(\rho\varepsilon u_i)}{\partial x_i}=\frac{\partial}{\partial x_j}\left[\left(\mu+\frac{\mu_t}{\sigma_\varepsilon}\right)\frac{\partial k}{\partial x_j}\right]+C_{1\varepsilon}\frac{\varepsilon}{k}G_k-C_{2\varepsilon}\rho\frac{\varepsilon^2}{k} \qquad (6)$$

Among them, G_k is caused by the average velocity gradient turbulent kinetic energy of k items, calculated by the next type,

$$G_k = \mu_t(\frac{\partial u_i}{\partial x_j}+\frac{\partial u_j}{\partial x_i})\frac{\partial u_i}{\partial x_j} \qquad (7)$$

Model constant of $C_{1\varepsilon}$, $C_{2\varepsilon}$, $C_{3\varepsilon}$, σ_ε, σ_k values as follows,

$C_{1\varepsilon}$ =1.44, $C_{2\varepsilon}$ =1.92, $C_{3\varepsilon}$ =0.09, σ_ε =1.3, σ_k =1.0

1.3 The Boundary Conditions

(1) Solid wall conditions. $k-\varepsilon$ model is of high Reynolds number model for fully developed turbulence is valid, and the near wall region flow, low Reynolds number, the turbulent development is not sufficient, the pulsation of the turbulence effect is inferior to the influence of the molecular viscosity is big, so in this area will not be able to use $k-\varepsilon$ turbulence model calculation, must use the special way of processing, the quantity on the wall linked with corresponding physical quantities of turbulent core area, that is the wall function method. [2]

(2) Inlet boundary. According to the design flow and inflow in pumping station can be learned that the cross section at the entrance section size of the average flow velocity, velocity distribution as inlet boundary conditions.

(3) Outlet boundary. Due to unknown before solving the export of velocity and pressure, and think that flow at the exit is completely the situation of the development. Exports as free discharge.

(4) Free water surface. If the surface of the pool of free surface, ignore the surface wind cause shear stress and heat exchange of the atmosphere, the free face velocity and turbulent kinetic energy treated as a symmetry plane. [2]

2. THE RESEARCH OBJECT

In electric irrigation district main line 5th pumping station as an example, its plane structure as shown in Fig. 1. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 represent the number of pumping station pumps. Among them, 1, 10 pipe diameter is 800 mm, flow rate of 0.85 m^3/s. 2, 3, 4, 5, 6, 7, 8, 9 pipe diameter is 1200 mm, flow rate of 3.0 m^3/s. Upstream channel design flow for 18 m^3/s, increase traffic for 21 m^3/s.

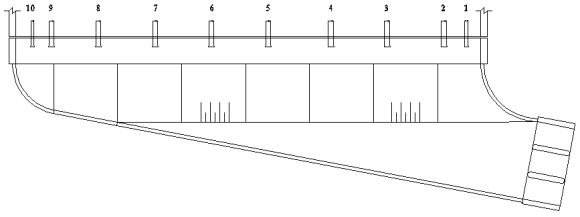


Figure 1 Electric irrigation district main line 5th pumping station plane sketch

3. THE RESULTS OF THE STUDY AND ANALYSIS

Fluent software including finite difference method, finite volume method, the finite element method, finite analysis method and so on a variety of ways to solve the control equations. The basic process of the flow field calculation is on the space area was calculated by the finite volume method is divided into many small unit volume, on a per unit volume of discrete control equations using separate solve the SIMPLE algorithm in solving. [3]

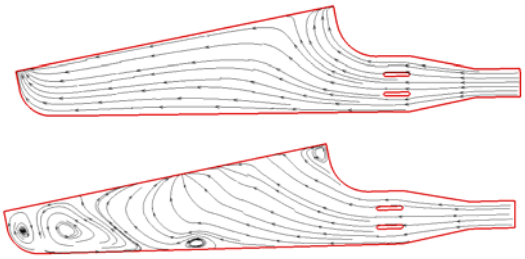
3.1 The Flow Regirne Under Different Switching-On Decision-Marking Numerical Simulation

Lateral forebay, the water pump at 1, 2, 3, 4, 5 units open state, the forebay formation of backflow region is more, and the area is larger, at 7, 8, 9, 10 water pump inlet ahead, has formed a wide range of dead

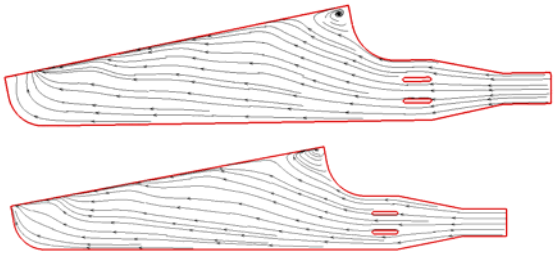
area, easy formation of sediment deposition in these areas. When the water pump to open other combinations, forebay rarely appears circumfluence region, general ahead of the no. 1 and no. 10 pump is easy to form small scope reflux or low velocity zone, so open in other combinations in deposition is comparatively light. Thus, when lateral water, sedimentation mainly appear in the far side of the forebay.

3.2 The Influence Of The Forebay Structure On The Flow Regirne

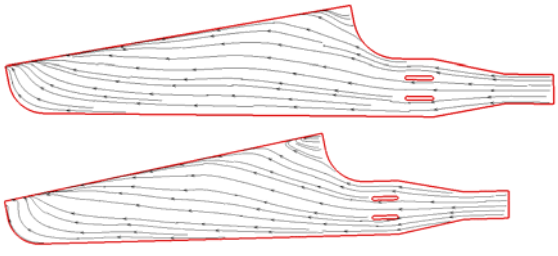
The numerical simulation, we take the candy, pressure plate in the bottom of a pool before setting. In electric irrigation area main line 5th pumping station as an example, the lateral forebay sedimentation deposition generally focus on 7, 8, 9, 10, the front of the pump, this is because when the flow to the in front pump flow rate was reduced by, therefore in the pump station to water flow variable hours, as far as possible open 7, 8, 9, 10, water pump, in order to reduce the generation of sediment deposition.



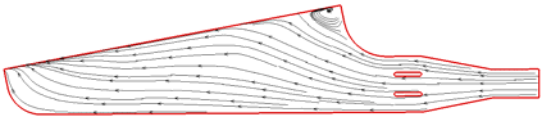
1,10 units open 1,2,3,4,5 units open

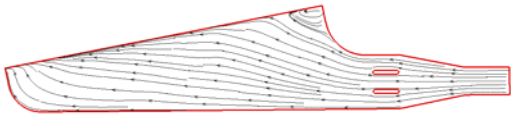


1,3,5,7,9 units open 2,4,6,8,10 units open



6,7,8,9,10 units open 2,3,4,5,6,7,8,9units open





1,2,3,4,7,8,9,10 units open All units to open

Figure 2 Speed streamline

4. CONCLUSION

Found through the numerical simulation, pumping station forebay Sdimentation is mainly related to the following three aspects, ① The flow regime. Numerical simulation and model test research found that the flow regime in the forebay is one of the main factors affecting the class pumping station forebay sedimentation. Carrying water with high concentration of two phase flow into the pool after the formation of the reflux area sediment deposition is serious, don't often open times near the water pump inlet pipe, the mainstream of the forebay area and no reflow area deposition is lighter. ② The unit open composite state. Avoid close the forebay far end side of the unit operation combination, effectively improve flow pattern and reducing the forebay sedimentation,③ The forebay structure. Change the forebay local structure, adjust the pump station engineering measures such as arrangement of unit, and effectively improve forebay water flow, reduce sediment deposition.

Hydraulic model test and field investigation and analysis shows that numerical simulation method is applied to different forebay structure and pumping station forebay under different boot combination state of silting situation are in good agreement with those obtained with the actual situation. Analysis pumping station forebay are simulated by means of this method can be similar to the water flow state of construction engineering design to provide theoretical basis for preventing silt can also provide decision basis for the operation of large pumping stations.

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High Efficient Area Ratio Match and Universal Test Platform Design for Electric Vehicle

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Abstract: To meet the test requirement of different kinds of high efficient ecology conservation optimization(ECO) innovative direct-drive auto-transmission system, a design method of general test bench which is based on electric vehicle(EV) was presented. Under consideration about the usual drive speed district and the high efficiency running district of drive motor, a high efficiency transmission ratio was confirmed; calculate the equivalent moment of inertia of transmitter output bearing which is related to the whole car during the car running process, use electrical inertia simulation device to replace mechanical inertia simulation device, and improve the simulation accuracy during gear shifting process; refer to the design data of domestic car type, design the general test bench of EV power system which could accomplish the performance test of different cars and different conditions. The test result could establish a better theoretical foundation for the performance research of EV which load the direct-drive auto-transmission system.
Keywords: High efficiency transmission ratio, mechanical inertia simulation device, general test bench

1. INTRODUCTION

The E-motor is the power of transmission system which is used by EV, so the corporation of motor and transmission system could significantly affect the dynamic and ECO of vehicle. Now most people consider to improve the transmission ratio when they work on the data match of motor and transmission system to make the motor run in the high efficiency zone, in order to lower the energy and improve the drive distance. Tests [1-3] make the motor work in high efficient area through improving the transmission ratio, but they did not consider when in usual speed the motor also should work in high efficiency zone closely. The motor and transmitter are matched based on the satisfaction of EV design targeted [4-6]. Although it satisfied the requirement of dynamic and ECO, it does not consider how to improve the motor efficiency. Although the test [7] considered the motor running efficiency when matching the transmitter, it does not consider to match the transmission ratio by connecting the usual running speed and motor high efficient speed area. Although previous research [8] considered about the motor efficiency problem in usual running speed when matching the transmission ratio, we could only get a transmission ratio range, finally check the transmission ratio which you choose could satisfied the motor runs in high efficiency zone.

Bench Test is an efficient method to check if the EV transmission design is reasonable or not, and the vehicle inertia simulation is the key of bench test. Because of the electrical inertia simulation has the advantage of continuous inertia simulation range, less volume, running safely and so on [9-10], so now the mostly inertia simulation methods of EV transmitter synchronizer test bench system is electrical inertia simulation. Even though, because the turbo lag effect from electrical inertia simulation cannot be solved finally, so that the simulation accuracy is far more un-accurate compare with mechanical inertia simulation which cannot simulate the real-time rotational inertia numerical under different kinds of conditions.

This article which firstly was based on the motor efficiency during pure EV transmission parameters match, presenting a method of how to calculate the high efficient transmission ratio which was based on usual speed intermediate value and high efficient area intermediate valve of drive motor to guarantee the motor always works in high efficient area when running in normal speed. Then present a EV gear shifting general test bench design thoughts which used a less volume, easy loading/unloading variable inertia flywheel based on turbo lag effect of the bench test electrical inertia simulation method which improves bench simulate accuracy of the transient conditions, at the same time satisfying the gear shifting test of different kinds of vehicles.

2. THE CONFIRMATION OF HIGH EFFICIENT ZONE TRANSMISSION RATIO

The selection and matching of EV power system is always the key point of EV researching. After confirming the motor which is based on EV dynamic performance index, we should also match the transmission ratio to satisfy the requirements of different conditions when EV runs. Although the usage of fixed ratio reducer could less the EV weight, it is hard to guarantee the motor works in high efficient zone, so the task use multi-gear

transmission.

In order to develop the best performance of motor, we could calculate a transmission ratio based on the intermediate value of both EV normal running speed and motor high efficient zone. As per motor rotate speed and vehicle speed below

$$u = 0.377\frac{rn_{dj}}{i_g i_0} \quad (1)$$

where u is speed(km/h); r is wheel rolling radius; n_{dj} is motor rotate speed; i_g is transmitter ratio; i_0 is the main reducer gear ratio.

After confirming the main reducer gear ratio, as per equation.(1) we could get high efficient zone transmission ratio based on below

$$i_{gx} = 0.377\frac{n_{mid}r}{u_{mid}i_0} \quad (2)$$

where i_{gx} is high efficient zone transmission ratio; i_0 is main reducer transmission radio; r is wheel rolling radius; n_{mid} is intermediate value of high efficiency speed area of motor; u_{mid} is intermediate speed of usual running speed.

When vehicle runs in high efficient transmission ratio, motor always works in high efficient rotate zone so that less energy consumption and increase the driving range.

3. BENCHINERTIASIMULATIONDEVICE

Firstly we calculated the whole vehicle's equivalent moment of inertia when we made the vehicle inertia simulation on test bench. The structure plan of gear shifting system test bench is shown in Fig. 1

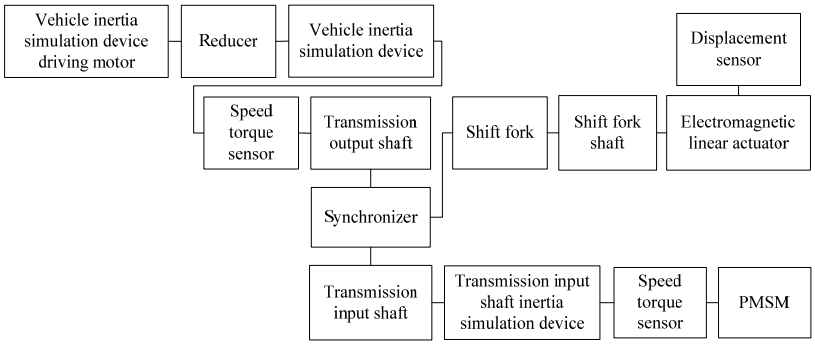

Figure 1 Test bench structure scheme of shift system

As Fig. 1 showed, considering about the gearbox input shaft inertia simulation device, the rotary inertia it simulates is the value of rotary inertia which are all connected rotary parts between EV motor and transmitter input shaft. As per rotational inertia of the solid dish formula

$$J = \frac{1}{2}mr^2 \quad (3)$$

where m is the disc quality; r is the rotating radius of the disc around the axis.

As per normal EV data, we could get the rotary inertia range 0.01~0.03kg•m^2 which is simulated by gear box input shaft inertia simulation device as equation.(3). Considering the variability of rotary inertia and easy load/unload of inertia disk which is simulated by inertia simulation device, finally, the gear box input shaft inertia simulation device includes one main disc with inertia 0.01kg•m^2 and four deputy disc with inertia 0.005kg•m^2. The deputy disc will be loaded by real requirements as per the rotary inertia which needs to be simulated. The outer diameter of main disc is same, but the inner diameter is less which could be connected with inertia disc shaft by symmetric flat key. Besides, the positioning boss which processed in main disc is matched with positioning groove which is in deputy disc could avoid the centrifugal rotation. The inertia main disc and deputy disc is strictly connected by positioning bolt of the uniformly distributed along the circumference.

The rotary inertia which is simulated by the vehicle inertia simulation device is the sum of the vehicle translational inertia, the main reducer, the differential, the half-shaft and wheel rotary inertia. Simulate the vehicle translational inertia equivalent after the transmission output shaft but before the main reducer. By the law of conservation of energy, the sum of the translational kinetic energy and the rotational kinetic energy of other rotating parts such as wheels when the vehicle runs is equal to the kinetic energy from transmission output shaft on the bench to the output shaft inertia disc[11]. The kinetic energy from transmission output shaft to the output shaft inertia disc on the bench is

$$\begin{aligned} E_{sc} &= E_1 + E_2 + E_{fl} \\ &= \frac{1}{2}J_1\omega_{sc}^2 \times 2 + \frac{1}{2}J_2\omega_{sc}^2 + \frac{1}{2}J_{fl}\omega_{sc}^2 \\ &= \frac{1}{2}(2J_1 + J_2 + J_{fl})\omega_{sc}^2 \\ &= \frac{1}{2}J\omega_{sc}^2 \end{aligned} \quad (4)$$

where E_{sc} is the kinetic energy from the transmitter output shaft to the output shaft inertia disc; E_1 is the kinetic energy of Speed torque sensor coupling; E_2 is the kinetic energy of Speed torque sensor; E_{fl} is the kinetic energy of Output shaft flywheel; J_1 is the

rotary inertia of Speed torque sensor coupling; J_2 is the rotary inertia of Speed torque sensor; J_{fl} is the rotary inertia of Output shaft flywheel; ω_{sc} is the angular velocity of gearbox output shaft; J is the sum of inertia of all rotating parts from the Transmission output shaft to inertia disc on the route of transmission line.

By the law of conservation of energy

$$\frac{1}{2}mv^2+\frac{1}{2}J_{zd}\omega_{cl}^2=\frac{1}{2}J\omega_{sc}^2 \qquad (5)$$

where m is the weight of whole vehicle; v is the speed(m/s); J_{zd} is the sum of rotary inertia of the wheels and other rotary parts; ω_{cl} is the angular velocity of wheels.

Replace the angular velocity by rotate speed n(r/min) in equation.(5), the vehicle speed v(m/s) is changed to km/h

$$J=7.0433m\left(\frac{u}{n_{sc}}\right)^2+J_{zd}\left(\frac{\omega_{cl}}{\omega_{sc}}\right)^2 \qquad (6)$$

where n_{sc} is the rotate speed of transmitter output shaft.

Because the motor shaft is connected with the transmitter input shaft, as equation.(1) gets

$$u=0.377\frac{rn_{sc}}{i_0} \qquad (7)$$

Put equation.(7) into equation.(6)

$$J=m\left(\frac{r}{i_0}\right)^2+J_{zd}\left(\frac{1}{i_0}\right)^2 \qquad (8)$$

The first item in the right of equal sign is the vehicle translational inertia in equation.(8), the second item is the rotary inertia of the wheels and other rotary parts. The figure of J_{zd} could get by the calculation formula of the rotational inertia of the solid disc and homogeneous ring.

We can get $J=2J_1+J_2+J_{fl}$ from equation.(4). Considering about the speed torque sensor and its coupler, the figure of rotary inertia is very small which could be ignored. As a result, $J\approx J_{fl}$, as a result, refer to equation.(8), we could regard the vehicle's equivalent moment of inertia equivalent to the transmitter output shaft flywheel disc.

4. GENERAL TEST BENCH DESIGN

The target of this bench is to supply a platform which could test non-clutch EV for gear shifting process. Firstly, we should guarantee the function requirements of the bench then the generality when design the bench. The function requires are as below:

(1)Satisfy the different gear shifting in transmitter.

There are 3 gears matched by transmitter to confirm the dynamic requirements and high efficient area, so the bench could accomplish the shifting of different gears.

(2)Confirm the change rules of optional shifting force during shifting process.

The shift jerk is calculated by shift actuator displacement and acceleration signal through the bench, as well as loading the speed torque sensor in the input and output shaft of transmitter to test the synchronizing torque and each shaft rotating speed in order to get the change rule of the optimal shifting force under satisfying the life of the synchronizer ring.

(3)Accomplish the different shifting test under different shifting data.

The shifting data of transmitter shifting process includes rotary speed difference and the rotary inertia of the synchronized part. In order to make the results more convincing, the bench should accomplish different shifting test under different rotary speed difference and rotary inertia of the synchronized part.

(4)Make the bench with more universality.

The main part on the bottom of test bench could move forward and backward, right and left to fit the shifting test of the different vehicle types and transmitter types.

The final 3D model of bench designed refer to the requirements and function plan is shown in Fig.2. There are two power conveying routes, one is the motor and the gearbox input shaft inertia simulation device which is connected with transmitter input shaft, and the other one is the vehicle inertia simulation device, drag motor and reducer which is connected with the transmitter output shaft.

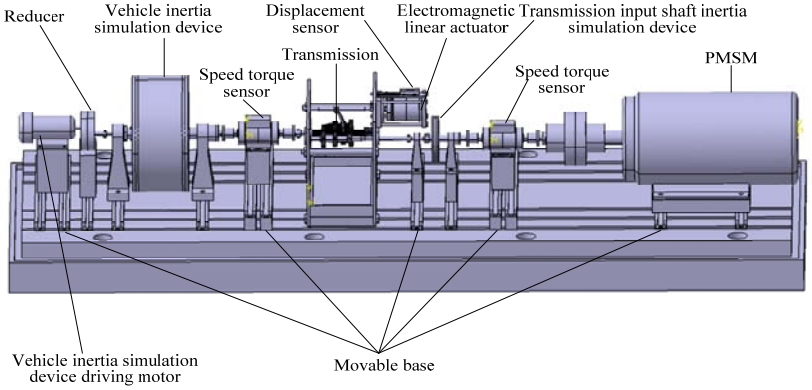

Figure 2 Three dimensional model of test bench

The working principles of the bench are shown in Fig.3

The vehicle inertia simulation device is used to simulate the vehicle equivalent moment of inertia, connected with transmitter output shaft. Because of the bigger volume of inertia disc and the bigger rotary inertia of vehicle inertia simulation device, in order to simulate the shifting process precisely when vehicle runs, it needs to load a set of driving device to make the inertia disc of vehicle inertia simulation device to get a rotate speed in advance[12]. There is synchronizer between the transmitter input and output shaft.

The inertia simulation device of transmitter input shaft is used to simulate the inertia of all connected rotating parts from motor to transmitter input shaft which is connected with transmitter input shaft. The speed torque sensor which is connected with transmitter input/output shaft monitors the variation of input/output shaft and torque in real-time. The displacement and ampere sensor monitors the electromagnetic linear actuator's axial displacement and working current.

Before testing we should set the torque difference and value of rotary inertia which need to be simulated, control the motor to drive the transmission input shaft to run by the motor controller, when the signal which is feedback from the speed torque sensor could meet the requirements, break the permanent magnet synchronous motor(PMSM) then switch on the electromagnetic linear actuator which drive the shift actuator to accomplish the gear shifting process. The controller receives feedback from each sensor to realize the real-time controlling during shifting process, connect the personal computer(PC) through controller area network(CAN) main wire and sent the signal to PC. The rotary inertia of synchronized part could be simulated by the transmitter input shaft inertia simulation device on the bench within the range of 0.01~0.03kg•m^2. The vehicle inertia simulation device could simulate the vehicle's equivalent moment of inertia within the range of 8~13kg•m^2. The range(8~13kg•m^2) includes the vehicle's value of rotary inertia of normal family EV. The highest rotate speed of the PMSM which connected with transmitter input shaft could reach 3500r/min so that the bench could simulate gear shifting process of different vehicle types and shifting data.

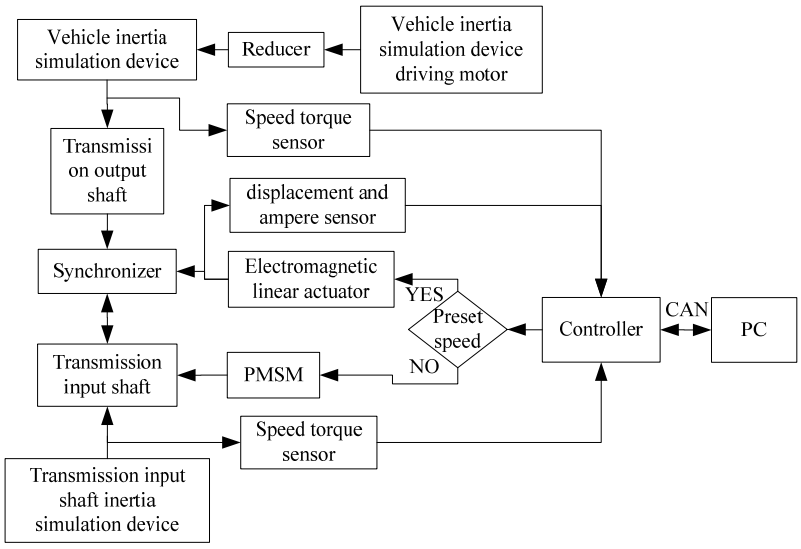

Figure 3 The working principle of test bench

It is shown from Fig. 2, there are 6 T type grooves in the bottom of the bench, and the bottom of every parts on the bench is movable designed, realizing the forward/backward and right/left moving though the corporation with T type grooves to make the bench universality usage.

5. CONCLUSION

(1)According to the principles of EV transmission system data matching, we presented a calculation method based on the motor which can works in high-efficient area in order to guarantee the motor work in high efficient area when the EV runs in usual speed. And improve the motor efficiency and driving distance which present a theoretical principles to multi-gear EV transmission system data matching.

(2)Considering about the turbo lag effect existed in the method of electrical inertia simulation of EV test bench, we designed a mechanical inertia simulation device which is with less volume and easy loading/unloading variable inertia flywheel disc. With the usage of the separate simulation the vehicle's equivalent moment of inertia methods, it improves the bench simulation accuracy in transient condition. Design a universal test bench of non-clutch EV synchronizer shift process which could not only accomplish the gear shifting test under different rotate speed difference and rotary inertia of the synchronized part, but also could provide the shifting

test to different transmitters with different vehicle types.

6. ACKNOWLEDGMENT

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The Control System Design of Smart Wallet

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Abstract: In the analysis of existing strengths and weaknesses based on smart wallet, purse design a new intelligent control system. This design from the actual needs, design and implement smart wallet, features include: scratch-theft, anti-lost, anti-degaussing card, mobile phone and wallet to find each other, remote keyless entry with each other to find the wallet, keys and cell phone each other to find the remote control, remote keyless entry and other electronic devices to find each other, such as pad and other consumer electronic products.
Keywords: wireless sensor networks; robust; routing; load balancing

1. INTRODUCTION

Currently on the market common smart wallet are:
ICONIC third edition of the iconic smart wallet, Intelligent anti-theft wallet, WALLI smart wallet, SEE BY CHLOE Rosita smart wallet, IWALLET high-tech smart locks wallet, ZEUSE CLASSIC fashion tide models wireless phone charging wallet, Smart carbon fiber wallet fingerprint security.
The current product has the following disadvantages:
(1) This product is not designed to be easy to carry wireless sensor keys, encryption keys and wallet through mutual authentication, both the induction key alarm.
(2) The product will be wireless charging power to put in your phone in order to achieve charging function, support wireless charging, but does not consider the impact on package bank cards and ID cards, etc. Such charging and discharging, and so easy to cause the bank card degaussing phenomenon, affecting the normal use.

2. PRODUCT DESIGN

a. Induction key remote control to open their wallets, beyond the set distance, purse automatically locked, to prevent the loss of valuables.
Sensing distance wallet key within the set distance, by sensing the key to unlock the key to open the wallet, purse end miniature electric locks, (power locks with two, respectively, by induction key control, keyboard control and password, respectively called first-stage and second-stage electric locks electric locks), wallets control box receives the transmitted unlock key after blocking signal, power locks performs a switching operation.When the distance between the sensor keys and wallet out of the setting distance, purse power locks automatically locked to prevent financial and valuables missing (except for damage and destruction of means).
b. In order to increase the safety of electric locks, installed on the side of the wallet 25mm * 40mm soft keyboard password, after the first stage electric locks open, only enter the correct password before opening the second stage electric plug lock, to better protect the financial security.Can be set through the system does not use the first-stage and second-stage power locks, then our wallets and purses, like ordinary, easy to open manually.If the person holding the package from entering crowded situations, can be set to open the first stage, the second stage electric locks, strengthening degree of protection against financial loss.
c. The metal shield used to protect the card against demagnetization, etc., the outer layer of the card is located inside the wallet, the card and protect anti-demagnetization function, cassette surface using a fabric material, the internal use pure ionic silver metal shield made of metal mesh, placed in bags to protect a variety of cards, in which the data protection information, to eliminate static and reduce electromagnetic interference on the card to store data, prevent data loss and avoid trouble caused by degaussing.

2.1 Control Box Structure And Principle

Control box purse is the core control unit, which includes button batteries, Bluetooth module, the control circuit and the corresponding line. Composition diagram shown in Figure 1.

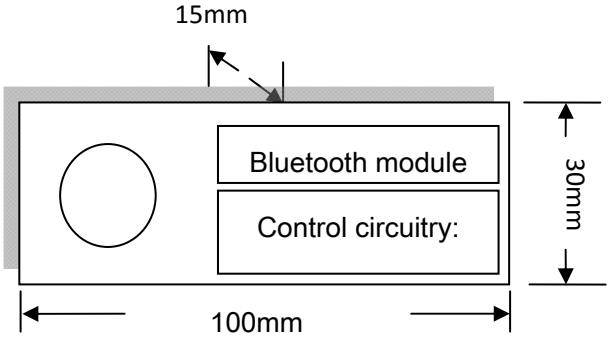

Figure 1 control box chart

Button battery parameters shown in Table 2.

Table 2 button cell parameters

Attributes	value
OD	About 20 mm
thickness	3.2mm
high	0.4 ± 0.10mm
Resistance	1K
Implementation of standards	GB / T 8897.2
Rated voltage	3V

3. RESULTS AND DISCUSSION

(1) anti-theft gash feature: smart wallet is currently still in development stage, and market smart wallet

does not have anti-theft features gash. The paper design to achieve a scratch-theft alarm, when holding the package's personnel crowded public places (subway, shopping malls, supermarkets, etc.), when thieves with a blade change for wallet ready to steal, this purse will be audible and visual alarm warning thieves remind those holding the package to protect the package by holding property, to avoid economic losses.

(2) wallets, cell phones and other consumer electronics products Anti-lost: the current launch of the smart wallet with each other and bound phone wallet, cell phone and wallet when the distance exceeds a set value, the cell phone and wallet were an alarm signal. But when the cell phone and wallet with missing, no alarm information, to support the package, bringing economic losses. The paper design to achieve a Bluetooth-based remote control key which is worn on the person holding the key chain or a bag of clothes, wallet and key fob when distance exceeds a preset value, the key will send vibration alarm. In addition, the key can be bound to mobile phones, mobile phone anti-lost function to achieve, can also bind the pad, to achieve anti-lost function, but can connect up to three from the device in order to protect people and property.

4. CONCLUSION

In this paper, design of the anti-theft and the wallet has the following characteristics:

(1) simple operation, The remote control key can be easily achieved wallet, cell phone anti-theft, anti-lost, find each other.

(2) increase in the number of useful properties, such as keys vibrate, keys and wallet to find each other, find each other mobile phone and wallet, mobile phone and pad to find each other, the corresponding function has been explained previously.

(3) production costs. The paper are strong functions, development costs are relatively high, this team is working hard to reduce development costs, the sale price of the finished product is expected around 1000.

6. ACKNOWLEDGEMENTS

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The Design of New Intelligent Wallet

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Abstract: Ride in crowded areas bus, subway or Language shopping malls, supermarkets, etc., due to staff crowded, cluttered environment, the thief will provide an opportunity. Some wallets are stolen, lost; some are planning to open the wallet was stolen package of cash and valuables; some phone is stolen and lost, to bring unnecessary loss of economic assets. In order to prevent theft and loss of wallets, mobile phones and other valuables, this paper design of the anti-theft, theft of smart wallet for people and property safety escort.
Keywords: wireless sensor networks; robust; routing; load balancing

1. INTRODUCTION

Few products currently theft smart wallet, looking at home and abroad are:

there has been a named ibag wireless charging anti-lost wallet Jingdong crowdfunding platform. The wallet has a purse of ordinary appearance, not only has anti-lost function, but also has a wireless charging function for mobile phones. At present, the purse which has been on the line in Jingdong crowdfunding, crowdfunding price of 399 yuan. Ibag anti-lost wallet is a wallet and a common anti-lost and wireless charger components. After the package by holding a mobile phone via Bluetooth 4.0 connection therewith, when the phone is out of the setting distance away from wallet, cell phone and wallet will simultaneously alert, and when the phone can not be found, double-click the phone anti-lost wallet can be issued within sirens, and when you can not find or wallet, the APP in the cell phone click on "find" to make the phone sound an alarm, to achieve anti-lost function.

The current product has the following disadvantages:

(1) that no purse theft features such as burglar with a blade cut open the skin purse, steal package of cash and valuables, holding the package will not know.

(2) the product via Bluetooth cell phone and wallet connections when the phone and wallet in which one exceeds the set from the other party will issue a warning signal, can effectively avoid the phone, I lost my wallet. But when you lose your phone and wallet at the same time, the product will not be a timely warning to avoid the loss of both cell phone and wallet.

2. PRODUCT DESIGN

This paper design to achieve the theft of a smart wallet, the wallet key bag body and comprises an inductive lumpy. Only the person wearing the key before easily open the purse, wallet is not the key sensing range, wallet automatically locked. When the packet is a thief scratched the surface, the sensor keys will be audible alarm to alert the support package wallet was scratched, take urgent measures to avoid economic losses. The key can be bound wallet, mobile phones, tablet PCs and other intelligent electronic products, if any items are bound to leave the key 12 meters, the key buttons immediately audible alarm to alert the user to prevent financial loss and theft. Wallet inside a metal shield layer design consisting of bank card storage layer, effectively avoid bank card magnetic stripe damage.

2.1 The Composition, Structure And Principle

The wallet from the main wallet and coin sensing keys of two parts.

The purse and wallet on the market from the surface, there is no difference, the product includes a surface layer sensitive layer, storage layer and the control layer. Surface material is divided into leather, fabric two kinds. Sensitive layer is a layer of access to information perception wallet, close to the internal surface, at various levels by the resistance wire hybrid components. Storage layer including cash and vouchers storage layer, layer storage cards, mobile phones and valuables layer. Control layer composed mainly consists of a control box, the control box has a button battery, Bluetooth module, sensor module.

Induction keys comprising: a battery, Bluetooth module, sound and light alarm module, sensing module.

The following details purse body composition and induction key principle respectively.

Constitution and principle (1) purse body

The appearance of the wallet size of 1500mm * 800mm * 300mm, wherein the length of 1500mm, width of 800mm, thickness of 300mm.Purse body dimensions shown in Figure 1.

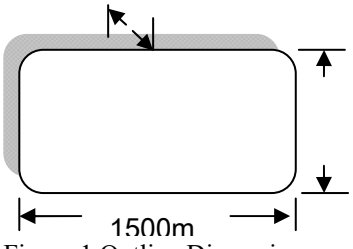

Figure 1 Outline Dimension

Induced by the mesh layer hybrid chip resistors and circuit configuration, when the factory is a stable resistance value, when the thieves cut open the skin with a blade and chip resistors network, the total resistance will change purse, wallet control box detection after the change of resistance beyond the range of error, start sound and light alarm signal to

alert the person holding the package, warning thieves. Hybrid resistance mesh network structure shown in Figure 2.

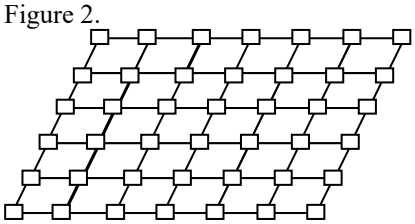

Figure 2 mesh hybrid resistance network configuration diagram

The algorithm program flow chart shown in Fig.2,

3. RESULTS AND DISCUSSION

(1) keys and wallet, cell phone, pad mutual search: existing smart phone and wallet purse can achieve mutual find that when the wallet can not be found, you can find instructions issued by phone, if within the communication range wallet, purse will start sound and light alarm to remind those who support package, seeking to realize the function package. This paper uses Bluetooth 4.0 implements keys and wallet, cell phone, pad function to find each other, but it must be within the communication range, generally less than 30 meters.

(2) Anti-degaussing card: The current smart wallet does not consider bank cards, ID cards, bus cards and other anti-degaussing function, this paper uses metal mesh braid shield from outside interference, to protect bank cards, ID cards and other security, degaussing avoid trouble to the user, effectively guarantee the safety of magnetic stripe cards.

4. CONCLUSION

In this paper, design of the anti-theft, theft of smart wallet for people and property safety escort. The paper respectively bank cards, bus cards, a variety of gift cards, stored value cards were experimentally tested and found that the bag can effectively protect the safety card, can reduce the rate of about 10% degaussing. Preliminary measurement weight of about 0.4KG.

5. ACKNOWLEDGEMENTS

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The Design of Wind Turbine Fault Diagnosis System

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Abstract: the system permanent magnet synchronous generator as a sample for each system fan running status, the use of technical means to monitor and analyze big data binding, intended to develop a fault diagnosis and early warning systems so that the operating state of each wind turbine components are effectively monitored to assess equipment operating trends, early warning device can signal deterioration. Implementation of this project will not only improve the management of wind power owners, avoid major equipment failures, but also to develop a test method for testing this type of wind turbine, the domestic research and development of large wind turbines is also quite instructive.
Keywords: Wind; Turbine; Fault Diagnosis

1. INTRODUCTION

High-Power permanent magnet synchronous wind turbine has become the development trend of the current wind turbines, many domestic wind turbine manufacturers in the past three years to invest a lot of resources have been developed 2MW, 3MW, 5MW and higher capacity wind turbines.These units use of permanent magnet synchronous generators and power converter with no gear box design and development process more relying on its own strength, making China"s wind turbine manufacturing capacity among the highest in the world.At present, these wind turbines installed capacity of 2MW larger, 3MW over yet large-scale promotion, the majority of the test unit.

2. PRODUCT DESIGN

This paper design to achieve the wind turbine fault diagnosis system. High-Power permanent magnet synchronous wind turbine has become the development trend of the current wind turbines, many domestic wind turbine manufacturers in the past three years to invest a lot of resources have been developed 2MW, 3MW, 5MW and higher capacity wind turbines. These units use of permanent magnet synchronous generators and power converter with no gear box design and development process more relying on its own strength, making China's wind turbine manufacturing capacity among the highest in the world. At present, these wind turbines installed capacity of 2MW larger, 3MW over yet large-scale promotion, the majority of the test unit.

If the corresponding alarm event is triggered, such as loose bolts, surface contamination and corrosion, cracks in the ground and the tower is not strong, yaw gear wear, yaw sound abnormal sound, positioning accuracy, etc., the corresponding alarm button will flash, further for more inquiries fault location, but also to stop the operation of the machine, to avoid the loss of the device.

Unit parameters are divided into: Wind turbine parameters set parameters, set the parameters of wind turbine nacelle, generator sets parameters, the parameters of impeller blades parameters, the parameters of the wind turbine tower, yaw system parameters, motor parameters yaw, pitch system parameters change paddle motor system parameters.

2.1 Common Problems

Is greater than the threshold velocity, the control grid wind turbine ready to cut all the preparatory work: Loosen the mechanical brake to recover the tip of the damper plate, the wind wheel in the direction of the wind. The control system continuously detect the sensor signal is normal, if the hydraulic system pressure is normal, whether the deviation from the wind direction, and other network parameters are normal. Such as 10-minute mean wind speed is still greater than the starting wind speed, the wind is detected whether the wheel begins to turn, and turn on the thyristor limit soft start means quick start wind turbine, and the starting current is controlled so as not to exceed the maximum limit. Asynchronous generator at the start, because of its speed is very small, when it cut the grid great slip, which will produce the equivalent of 5 to 7 times the rated current of the generator inrush current, this current on the grid not only caused great the impact will also affect the life of wind turbines. So take the limit soft start technology in the wind turbine during grid to control the starting current. When the generator reaches synchronous speed current sharp decline, the controller issued a directive, the thyristor bypass. After the thyristor bypass, limit soft start controller automatically resets, waiting for the next start signal. The starting process about 40S or so, if more than this time, is considered the starting failure, the generator will be cut out of the grid, the controller based on the detection signal, determines whether the unit is restarted. Asynchronous wind turbine can also be the starting speed is below synchronous speed without grid, and so when approached or reached the synchronous speed and then cut into the grid, you can avoid the impact of current, but also save the thyristor limit soft starter.

During the wind turbine operation, a time due to

changes in wind speed causes the output power of the generator changes, the system should be able to control the size of the generator is switched automatically according to the generator output power change, to improve the efficiency of wind turbines. Specific control methods are:

(1) small generators to large generators handed over during a small generator and power generation, the control system detects its power output, if the instantaneous power over one second small generator rated power of 20 %, or an average power greater than a certain value, then the realization of small generators to large generators to switch within two minutes. The handover process: First cut compensation capacitor, then a small generator off the network, and so the wind wheel is free to rotate to a certain speed, and then achieve great generators of soft grid; if the wind speed in the switching process suddenly becomes small, so that rotor speed instead of reducing the case, then a small generator should be soft and network reimplement small generators and network operation.Output power

(2) large generators to switch to detect small generator large generators, if the average power is less than a predetermined value within 2 minutes (this value should be less than a small generator rated power), the instantaneous power or 50S less than another smaller set value, immediately switched to run small generators.Switching process: removal of large compensation capacitor generators, off-grid and small generators and network software, timing 20S, measuring small generator speed, if not after reaching the small 20S generator synchronous speed, then stop, control system reset, reboot.If the speed has been reached within the 20S small generator speed bypass the bypass thyristor soft starter, and then put the compensation capacitor reactive power according to system conditions.After the wind generator and network control system according to changes in wind speed by a pitch adjustment mechanism to change the blade angle of attack to adjust the output power, more efficient use of wind energy.At rated wind speed, blade angle of attack at this time in the vicinity of zero, it can be considered equivalent to fixed pitch wind turbine output power variation of wind speed generator changes.When the wind speed reaches above rated wind speed, variable pitch mechanism into play, adjust the angle of attack of the blade, guaranteed power output of the generator within the allowable range.However, due to the unpredictable nature of wind. Winds are always in constant flux, and a cubic relationship between wind speed and wind energy, small changes in wind speed will result in significant changes in the wind, causing the output power of wind turbines in a constant state of flux.For variable pitch wind turbine when the wind speed is higher than the rated wind speed, variable pitch mechanism intended to limit the power output of the generator, will adjust the pitch to adjust the output power.If the wind speed variation amplitude, high frequency will cause variable pitch mechanism frequently substantial movements to pitch mechanism easily damaged; the same time, the pitch of the blade pitch control mechanism from the large inertia of the system, there is a big lag time , pitch adjustment lag will cause greater fluctuations in the output power of the generator, causing some adverse impact on the grid. In order to reduce the adverse effects of pitch adjustment mode on the grid, it can be a new auxiliary power adjustment method -RCC (Rotor Current Control rotor current control) mode to match the pitch agencies to complete the generator output power adjustment .RCC control must be used on-line around the asynchronous generator by power electronic devices, control of the generator rotor current, so that ordinary asynchronous generator become variable slip generator. RCC control is a fast electrical control mode, to overcome the rapid changes in wind speed. Using RCC control variable pitch wind turbine, variable pitch mechanism is mainly used for wind speed slowly up or down by adjusting the blade angle of attack, adjust the output power; RCC control unit is applied to the rapid changes in wind speed, when the wind speed suddenly changes, RCC unit adjusts the slip of the generator, the generator's speed can be varied within a certain range, while maintaining a constant rotor current, the output power of the generator will remain unchanged.

3. CONCLUSION

In this paper, the development of a set of fault diagnosis and early warning system, so that the running status of wind turbine components are effectively monitored to assess equipment operating trends, early warning device can signal deterioration. Implementation of this project will not only improve the management of wind power owners, avoid major equipment failures, but also to develop a test method for testing this type of wind turbine, the domestic research and development of large wind turbines is also quite instructive.

4. ACKNOWLEDGEMENTS

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Risk Assessment Research on Transmission Line Project in Infection Zones of Coal Mining Based on Fuzzy Comprehensive Evaluation Method

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Abstract: With the development of coal resources and the expansion of cities' boundary, the volume of overhead transmission line in coal mining infection zones has been continuously increasing. The operation of mining will affect the security and stability of lines. Therefore, this article carries out a study of overhead transmission line project risk in coal mining affected zone based on fuzzy comprehensive evaluation. By analyzing risk factors to establish the evaluation index system, and determining indexes' weights via AHP method, and based on the results of case study, proactive advices on risk prevention of transmission line project in coal mining infection zone have been proposed in this article.

Keywords: Goaf; risk assessment; fuzzy comprehensive evaluation; analytic hierarchy process

1. INTRODUCTION

Coal is one of main energy sources in China, and may still play the important role for a long time in the future. [1] Coal mine widely distributes under buildings, railway and waters. With the expansion of cities' boundary and the development of economy &society, the volume of coal under buildings has been continuously increasing, which is more significant in electrical industry, due to more and more overhead transmission lines covering infection zones of coal mining. At present, we still cannot know infection zones of coal mining sufficiently both on risk response and the pattern to influence transmission lines. Mining always makes landmarks move and deform so to greatly influence projects of transmission lines, so that the safety of those projects there is even more important.

Coal mining may cause the surface to displace and deform, which will severely threaten the safety of transmission line projects. To specifically speak, the displacement of surface will cause differential settlement of iron tower footing to make towers and insulator strings lean, and then incur safety faults like trip which will seriously threaten transmission lines' operation and the safety of society, life and property. [2]Correctly assessing the risk of transmission line projects caused by infection zones of coal mining, is an important approach to ensure the safety of projects, while could help to propose corresponding advice on risk response. So far, there are a lot of researches on risks of transmission line project due to gale, ice and snow, and other disaster weather. [3]However, little research work involves risk assessment on coal mining zones. Therefore, in this article, taking some coal mining infection zone as an example, we assessed the risk of overhead transmission line project in this zone by analyzing corresponding risk factors and establishing an index system, and then evaluating risk based on Fuzzy Comprehensive evaluation Method. The research in this article aims to propose advice on safety assurance and risk prevention in power grid construction.

2. RISK ASSESSMENT INDEX SYSTEM OF OVERHEAD TRANSMISSION LINE PROJECT IN COAL MINING INFECTION ZONES

For transmission line project in coal mining infection zones, the risk is very high during selecting the type of lines, constructing and operating. The risk factors involve geographical location, landform, meteorology-hydrology, the quality of project itself, and so on. Therefore, combining an existing literature [4] and the current situation in study zone, we have established a 3-level risk assessment index system based on geological factor, hydrological factor, stability of goaf, and stability of transmission line project (See Tab.1)

Table 1. Risk assessment index system of transmission line project in coal mining infection zone

First level index	Second level index	Third level index
Risk assessment index system of transmission line project in coal	Geological factor u_1	Erosion modulus of goaf surface
		Landform factor
		Structure of overlaying strata
		RQD (Rock quality

mining infection zone		designation)
	Hydrological factor u_2	Average annual precipitation
		Groundwater
	Stability of goaf u_3	Ratio of mining depth to thickness
		Roof management mode
		Area of goaf
		Coal pillar settings
	Stability of transmission line project u_4	On-line monitoring device
		Measures to maintain and strengthen transmission lines

EROSION MODULUS OF GOAF SURFACE: The unit of soil erosion intensity is t/(km^2·a), which is a quantified index to measure soil erosion degree. Higher values indicate that under the synergistic action of natural forces (like hydraulic power, wind power, gravity, freezing and thawing) and human activities, larger volume of surface soil will be corroded and displace, and the risk of overhead transmission line is higher. Based on the standard issued by Ministry of Water Resources of China, we divide risks of overhead transmission line project into 4 levels: low risk region with a value under 200, [5] moderate risk region with a value from 200 to 500, high risk region with a value from 500 to 1000, and extreme high risk region with a value beyond 1000.

LANDFORM FACTOR: Due to different landform, the deformation of surface will be various. The mines exploited in mountain may be with big fracture and collapse, ones in plains may be with large subsidence, ones on slopes may cause landslide, fault, deformation and other disaster.

STRUCTURE OF OVERLAYING STRATA: Deformation and displacement during mining will be different due to different type of overlaying strata. While mining, overlaying strata will displace, crack or break to cause surface deformation at different degree due to various mining intensity and characteristics itself. Consequently, surface will continuously or intermittently subside when mining shallow ore bodies.

ROCK QUALITY DESIGNATION (RQD %): Drill on rock with a diamond bit (its diameter is 75mm) and double-layer core barrel while coring continuously. Among all rock cores by roundtrip drilling, pick out those with a length beyond 10cm, calculate the sum of their length, and then get the ratio of the total length to the footage per roundtrip in percent. When the yielding stiffness of rock mass is higher than the stiffness of roof -floor and holder, mining zone is stable, otherwise is unstable. When the rock quality is higher and the stiffness of rock mass is greater, the risk is less in the mining zone just under the rock. [6]

AVERAGE ANNUAL PRECIPITATION (mm): It is an average value that the sum of annual precipitation in several years in certain region is divided by the number of years or of annual precipitation collected from several observation stations. Greater average annual precipitation means higher risks of debris flow and landslide in goaf, which will increase the probability to damage overhead transmission line.

GROUNDWATER: Interaction between groundwater and rock makes the mechanical characteristic of rock change so that the strength will soften until failure. Some research shows that the uniaxial compressive strength will go down to a stable status when the moisture content of rock increases. The moisture content will go up with the accumulation of immersion time until saturation. [7]

RATIO OF MINING DEPTH TO THICKNESS (%): When the value of ratio is large, cracks with small values of the depth and width paralleling to working face will emerge during mining. This kind of cracks will open at first and close finally when the working face displaces forward. However, when the value of ratio is small, the goaf will severely influence earth surface so that many cracks emerge on earth surface and even cause subsidence. Besides, the values of cracks' width, depth and length are all large so that earth surfaces on two sides of those cracks will incur a large drop due to the displacement of rock mass in the goaf, which will seriously damage the transmission line. When the value of ratio is small enough, opencast mining is an option, where the smaller ratio is the better. In this article, opencast mining is beyond our consideration.

ROOF-FLOOR MANAGEMENT MODE: It is the main factor that makes wall rocks deform and displace. Various roof-floor management modes can protect wall rocks with different effect so that their subsidence will also different. According to the value of subsidence, risk of those management modes in ascending order is Caving method> Filling method>Strip mining method.

AREA OF GOAF(km^2)**:** With the increase of exposed roof's area in goaf, wall rock of goaf's roof will form a shape of upside-down pot that its rim around is fixed. In the section, roof could be treated as a simply supported beam which consists of multi-type strata. Under combined action of rock mass's dead weight and secondary stress field resulted from mining, the simply supported beam will bend and deform toward free surface of goaf, and its characteristics of stress will also change. When the exposed area of roof is too large so that tensile stress imposed on wall rock of roof is beyond the limit of rock mass's tensile strength, then damage, falling may be incurred, or vibration of blasting may impact on the goaf to cause falling. The above cases will follow *Caving Arch Theory*, that is, a stress generated by rock mass's dead weight has been directly imposing on roof upright in a finite area until the goaf is filled fully

with falling friable rock. During falling, earth surface will subside and crack due to the movement of strata. If mining is sufficiently, the surface will appear sunken pit and falling funnel. Therefore, the stability of surface depends on the area of goaf.

COAL PILLAR SETTINGS: By reserving coal pillar to protect transmission tower, the risk of mining will decrease, but meanwhile, coal resource will lose a lot, and mining layout and progress will be influenced seriously. Therefore, coal pillar's size and location will impact on the risk of transmission line project.

On-line monitoring device: By equipping tower lean monitoring device, transmission towers could be monitored on-line. The accurately measured and promptly sent parameters, such as the degree of lean along or across transmission line, and its angle, could better enhance professionals' ability of responding to emergency in transmission line project in time, and then help to lower the negative impact of mining zone on transmission line project.

Measures to maintain and strengthen transmission lines: By analyzing data from routine inspecting and observing the transmission line, operation parameters that are out of gauge could be regulated. Measures include adding adjustable stray, base electrification resetting, regulating the slackness of transmission line, and so on, which help to eliminate the impact of mining on deformation and displacement in transmission line project.

3. FUZZY COMPREHENSIVE RISK ASSESSMENT ON TRANSMISSION LINE PROJECT IN INFECTION ZONES OF COAL MINING

3.1 Fuzzy Comprehensive Evaluation Method

Fuzzy Comprehensive Evaluation (FCE) was firstly proposed in the article "*Discussion on Fuzzy Set*" written by L. A. Zadeh in California University, U.S.A. in 1965. [8] Since then, professor Zadeh had established the Fuzzy Set Theory and been keeping it gradually moving forward. FCE is based on fuzzy mathematics, could help to quantify some qualitative factors which are hardly defined or quantified in terms of fuzzy relationship synthesis, and then comprehensively evaluate the object with multi-factors. [9]

The basic process of FCE is shown as following: Firstly, quantify the evaluated object into a fuzzy set with several indexes, and set the level of each index. Secondly, establish evaluation set through experts or decision-makers assessing the object, and determine the membership of each index to different evaluation set to establish the fuzzy matrix. Then figure out the final matrix according to the distribution of index weight. Finally, calculate the final results of evaluation. [10, 11, 12] Thus, fuzzy comprehensive evaluation could properly deal with practical problems which are boundary-fuzzy or hard-to-be-quantified, and especially various uncertain problems.

In the real world, fuzzy phenomena exist everywhere. In a multi-variable, nonlinear, and changeable large scale system, it is too hard to accurately describe practical problems. In order to accurately describe practical problems in such a complex context, a balance between accuracy and simplification should be made, which is satisfied due to the fuzzy set proposed. Fuzzy set has been widely applied in various fields such as economy, management, automation, biology, and forestry.

Risk is a fuzzy concept itself with both positive side and negative side. It is generally defined as the possibility that a specific loss will occur within a specific time. That risk may occur or not is a problem with a fuzzy boundary. According to the concept of fuzzy mathematics, risk is higher, occurrence of loss is more possible and it is more danger. When the degree of dangerousness approaches a certain level, that is, the membership degree to high risk reaches a certain level, and then we can say the risk is very high.

3.2 Process Of Fuzzy Comprehensive Evaluation Based On Entropy Method

Fuzzy comprehensive evaluation method can avoid subjective influence and deal with objective fuzzy phenomena effectively during evaluation. The process of evaluation is shown below.

3.2.1 single-ahp fuzzy comprehensive evaluation

Determine evaluation factor set: $U=\{u_1,u_2,\ldots,u_n\}$. When selecting evaluation factors, we should pick up those ones which can describe the object's attribute thoroughly as for the main problem.

Determine judgment factor set: $V=\{v_1,v_2,\ldots,v_m\}$, where $v_j(j=1,2,\ldots,m)$ is m types of evaluation class. Because meanings, effects and weights are different among index, this set is only a range of an optional evaluation result as for a certain evaluated factor.

Determine membership degree matrix: as for single factor $u_i(i=1,2,\ldots,n)$, figure out the fuzzy set V as $(r_{i1}, r_{i2}, \ldots, r_{im})$, and then define fuzzy mapping f,

$$f : U \to \Gamma(V) \tag{1}$$

Calculate the fuzzy evaluation matrix R as below,

$$R = \left(r_{ij}\right)_{n\times m} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \cdots & \cdots & & \cdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix} \quad r_{ij} \in [0,1] \tag{2}$$

r_{ij} is the membership degree of the *i*th factor u_i to the *j*th comment v_j.

ESTABLISH THE COMPREHENSIVE JUDGMENT: Due to differential importance of each factor, the weight of each factor could be determined as $A=\{a_1,a_2,\ldots,a_n\}$, and the comprehensive evaluation is as following,

$$B = A \circ R \tag{3}$$

3.2.2 MULTI-AHP FUZZY COMPREHENSIVE EVALUATION

Set the *i*th factor u_i in the highest hierarchy corresponding to *k* factors as $U_i=\{u_{i1},u_{i2},\ldots,u_{ik}\}$, and determine the membership degree matrix R_i in the similar way described above .

$$R_i=\left(r_{ikj}\right)_{k\times m}=\begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1m} \\ r_{i21} & r_{i22} & \cdots & r_{i2m} \\ \cdots & \cdots & & \cdots \\ r_{ik1} & r_{ik2} & \cdots & r_{ikm} \end{bmatrix} \quad r_{ikj}\in[0,1] \tag{4}$$

r_{ikj} is the membership degree of the *k*th factor u_{ik} to the *j*th comment v_j .

Set the weight for each factor as $A_i=\{a_{i1},a_{i2},\ldots,a_{ik}\}$, and the second hierarchy evaluation is ,

$$B_i=A_i\circ R_i=(b_{i1},b_{i2},\cdots,b_{im}) \tag{5}$$

3.2.3 calculate the comprehensive evaluation

Comprehensive evaluation set b_{ij} reflects the membership degree of the *i*th factor to the *j*th comment v_j . "∘" stands for a specific composite operator, which is always max-min calculation type, that is, the principle component-determined operator $M(\wedge,\vee)$. During calculation, firstly take the minimum value, and then the maximum. The final result will only take the most significant factor into account:

$$b_{ij}=\bigvee_{l=1}^{k}(a_{il}\wedge r_{ilj}) \tag{6}$$

Further, calculate the highest hierarchical comprehensive evaluation:

$$B=A\circ R=A\circ\begin{bmatrix} B_1 \\ B_2 \\ \vdots \\ B_n \end{bmatrix}=A\circ\begin{bmatrix} A_1\circ R_1 \\ A_2\circ R_2 \\ \vdots \\ A_n\circ R_n \end{bmatrix}=(b_1,b_2,\cdots,b_m) \tag{7}$$

Where $b_j=\bigvee_{i=1}^{n}(a_i\wedge r_{ij})$ stands for the membership degree of evaluated object to the *j*th comment v_j .

3.2.4 establish weight set based on ahp(analytic hierarchy process)

AHP is very feasible in a context when the structure of object is complicated and the necessary data is deficient. AHP can help to quantify the subjective judgment of decision-makers.

BUILD JUDGMENT MATRIX: By comparing factors in pairs at each hierarchy, and according to the scale（1,2,…,9） in Tab.2, build judgment matrix.

Table 2 Scale description

Scale	Meaning
1	Two factor compared are the same important.
3	One factor is slightly important compared with the other one.
5	One factor is apparently important compared with the other one.
7	One factor is very important compared with the other one.
9	One factor is extremely important compared with the other one.
2,4,6,8	Take the median value between two neighbor judgments
Reciprocal of each value above	If the importance of factor u_i to factor u_j is c_{ij} , then the one of factor u_j to factor u_i is $c_{ji}=1/c_{ij}$

WEIGHT DETERMINATION AND CONSISTENCE TEST: Based on judgment matrix *P*, eigenvector of corresponding eigenvalue could be calculated, i.e., we can work out the rank of importance of each factor. After normalization of eigenvector, each factor's weight *A* could be figured out. Of cause, since the weight *A* is based on subjective estimation, it unavoidably has deviation. In this case, consistence test by using judgment matrix is a main way to verify if the assignment is reasonable or not. The test formulas are below,

$$CR=\frac{CI}{RI} \tag{8}$$

$$CI=\frac{1}{h-1}(\lambda_{\max}-h) \tag{9}$$

Where CR is consistence ratio; CI is consistence index of judgment matrix; RI is a random consistence index that its value is shown in Tab. 3.

$CR<0.1$ means that consistence test is passed, i.e., assignment of weight is reasonable; Otherwise, the judgment matrix should have been adjusting until passing the test.

Table 3 Random consistence index value

Dimension	1	2	3	4	5	6	7	8	9	10	11
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.50

3.3 DETERMINE MEMBERSHIP FUNCTION

Since there are a lot of index used to evaluate the risk of overhead transmission line project in coal mining infection zone, we choose the four logical partitions method to determine the membership function [13] (Tab. 4) and establish four classes of judgment set V = {I, II, III, IV}, in which I represents the extremely high risk, II represents the high risk, III represents the general risk, and IV represents the lower risk. Quantify the qualitative indexes by subjectively assigning values according to the description in Tab. 4. Risk evaluation value varies from 0 to 100 and the higher the risk, the higher the value. The boundary values of I, II, III and IV are 75, 50 and 25 respectively. Membership function of qualitative and quantitative indexes is measured according to Tab. 5, where *x* is the actual value of index.

Table 4. Risk assessment index classification of overhead transmission line project in coal mining infection zone

Index		Assessment grade			
		I Qualitative index value>75	II 50<Qualitative index value<75	III 25<Qualitative index value<50	IV 25>Qualitative index value
Geological factors	Goaf surface erosion modulus	>1000	500-1000	500-200	<200
	Landform	Low mountain region with steeps, slopes (> 30°), canyons or V-Valley. Water is developed.	Regions that low mountains transit to hills; Slope varies of 20° -30°, U-type valleys prevails with a few V-shaped valleys.	Regions are flat with broaden U-shaped valleys	Flat terrain
	Overlying strata structure	Loose	Fragmentation	Stratiform	Intact block
	Rock quality designation	<30	30-50	50-70	>70
hydrological factor	Average annual precipitation	>600	500-600	400-500	<400
	Groundwater	Long-term pouring water	Rainy season pouring water	Visible water marks surrounding wall rocks	No pouring water mark
Goaf of stability	Ratio of mining depth to thickness	<25	25-55	55-85	>85
	Roof management mode	Caving method	Caving method	Filling method	Strip mining method
	Area of goaf	>10	1-10	0.1-1	<0.1
	Coal pillar settings	No pillar, or irregular layout, or serious damaged pillar	No pillar, or arrangements are not standardized, or damaged pillar	Have pillar,but the layout is not standardized	Have pillar, and the layout is standardized
Stability of transmission line project	On- line monitoring device	No on- line monitoring device	There is an on-line monitoring device, but the network transmission signal is not stable	There is an on-line monitoring device, but the network transmission of information is incomplete	There is an on-line monitoring device, and the network transmission of information is complete
	measures to maintain and strengthen transmission lines	No measures to maintain and strengthen lines	There are simple measures to strengthen but not to maintain lines	There are measures to strengthen, but not to maintain regularly lines	There are measures to strengthen and to regularly maintain lines.

Table 5. Membership function for risk assessment index of overhead transmission line project in coal mining infection zone

Intervals	Evaluation Class			
	Ⅰ（t_1）	Ⅱ（t_1-t_2）	Ⅲ（t_2-t_3）	Ⅳ（t_3）
The value of x is in accordance with the risk class I, including the value t_1	$1-\frac{x}{2t_1}(x \le t_1)$ $1-\frac{t_1}{2x}(x \ge t_1)$	$\frac{x}{2t_1}(x \le t_1)$ $\frac{t_1}{2x}(x \ge t_1)$	0	0

The value of x is between t_1 and $\frac{t_1+t_2}{2}$, including $\frac{t_1+t_2}{2}$	$\frac{\|(t_1+t_2)-2x\|}{2\|t_1-t_2\|}$	$1-\frac{\|(t_1+t_2)-2x\|}{2\|t_1-t_2\|}$	0	0
The value of x is between $\frac{t_1+t_2}{2}$ and t_2, including t_2.	0	$1-\frac{\|(t_1+t_2)-2x\|}{2\|t_1-t_2\|}$	$\frac{\|(t_1+t_2)-2x\|}{2\|t_1-t_2\|}$	0
The value of x is between t_2 and $\frac{t_2+t_3}{2}$, including $\frac{t_2+t_3}{2}$	0	$\frac{\|(t_2+t_3)-2x\|}{2\|t_2-t_3\|}$	$1-\frac{\|(t_2+t_3)-2x\|}{2\|t_2-t_3\|}$	0
The value of x is between $\frac{t_2+t_3}{2}$ and t_3, including t_3	0	0	$1-\frac{\|(t_2+t_3)-2x\|}{2\|t_2-t_3\|}$	$\frac{\|(t_2+t_3)-2x\|}{2\|t_2-t_3\|}$
The value of x is in accordance with the risk class IV.	0	0	$\frac{t_3}{2x}(x>t_3)$ $\frac{x}{2t_3}(x<t_3)$	$1-\frac{t_3}{2x}(x>t_3)$ $1-\frac{x}{2t_3}(x<t_3)$

4. FUZZY COMPREHENSIVE EVALUATION OF OPERATIONAL EXAMPLES

In this article, transmission lines in a 1.9km^2 mining infection zone have been taken as the study object for risk assessment research. Firstly, experts assess the relative importance of indexes at first level and second one to get the judgment matrix as shown in Tab. 6, 7, 8, 9 and 10 respectively. Then calculate the weight vector of judgment matrix and consistency test are listed in Tab. 11.

Table 6 Relative importance judgment matrix P_1 of second level index

Second level index （u_i）	Geological factor	Hydrological Factor	Stability of Goaf	Stability of Transmission Line Project
Geological factor	1	1/5	1/6	2
Hydrological Factor	5	1	1/4	7
Stability of Goaf	6	4	1	8
Stability of Transmission Line	1/2	1/7	1/8	1
Project				

Table 7 Relative importance judgment matrix P_2 for the lower index of geological factors

Third level index （u_{1l}）	Erosion modulus of goaf surface	Landform	Structure of overlaying strata	Rock quality designation
Erosion modulus of goaf surface	1	4	6	8
Landform	1/4	1	5	7
Structure of overlaying strata	1/6	1/5	1	2
Rock quality designation	1/8	1/7	1/2	1

Table 8 Relative importance judgment matrix P_3 for the lower index of hydrologic factor

Third level index	Average annual	Groundwater

（u_{2l}）	precipitation	
Average annual precipitation	1	1/6
Groundwater	6	1

Table 9 Relative importance judgment matrix P_4 for the lower index of overlaying strata's structure

Third level index（u_{3l}）	Ratio of mining depth to thickness	Roof management mode	Area of goaf	Coal pillar settings
Ratio of mining depth to thickness	1	1/5	1/2	1/7
Roof management mode	5	1	6	1/2
Area of goaf	2	1/6	1	1/5
Coal pillar settings	7	2	5	1

Table 10. Relative importance judgment matrix P_5 for the lower index of project's stability

Third level index（u_{4l}）	On-line monitoring device	Measures to maintain and strengthen transmission line
On-line monitoring device	1	1/8
Measures to maintain and strengthen transmission line	8	1

Table 11 The weight vector of judgment matrix and consistency test

Matrixs' number	P1	P2	P3	P4	P5
Weight vector *A*	0.0779 0.2719 0.6026 0.0476	0.0752 0.1028 0.3221 0.4999	0.1429 0.8571	0.0598 0.3488 0.0893 0.5020	0.1111 0.8889
λ_{max}	4.2126	4.2194	2	4.1136	2
CI	0.0709	0.0731	-	0.0379	-
RI	0.9000	0.9000	-	0.9000	-
CR	0.0788	0.0813	-	0.0421	-
Does consistency test succeed or not?	Yes	Yes	Second-order matrix is consistent itself	Yes	Second-order matrix is consistent itself

According to the judgment set V and the membership function (Tab. 5), evaluate each index of the research object, and obtain the membership function value as shown in Tab. 12.

Table 12. Membership function value of each index

Second level index	Third level index	Original value	Membership function value			
			I	II	III	IV
Geological factors u_1	Erosion modulus of goaf surface	300	0.0000	0.0000	0.8333	0.1667
	Landform	45	0.0000	0.3000	0.7000	0.0000
	Structure of overlaying strata	70	0.3000	0.7000	0.0000	0.0000
	Rock quality designation	38	0.6053	0.3947	0.0000	0.0000
hydrological factors u_2	Average annual precipitation	580	0.3000	0.7000	0.0000	0.0000
	Groundwater	40	0.0000	0.1000	0.9000	0.0000
Stability of goaf u_3	Ratio of mining depth to thickness	35	0.1667	0.8333	0.0000	0.0000
	Roof management	80	0.5312	0.4688	0.0000	0.0000

	mode					
	Area of goaf	1.9	0.0000	0.6000	0.4000	0.0000
	Coal pillar settings	20	0.0000	0.0000	0.6000	0.4000
Stability of transmission line project u_4	On-line monitoring device	55	0.0000	0.7000	0.3000	0.0000
	Measures to maintain and Strengthen transmission line	30	0.0000	0.0000	0.7000	0.3000

Then comprehensive evaluation results at the second level have been worked out as following.

$$B_1 = [0.0752\ 0.1028\ 0.3221\ 0.4999] \circ \begin{bmatrix} 0 & 0 & 0.8333 & 0.1667 \\ 0 & 0.3000 & 0.7000 & 0 \\ 0.3000 & 0.7000 & 0 & 0 \\ 0.6053 & 0.3947 & 0 & 0 \end{bmatrix}$$

$$= [0.4661 \quad 0.3680 \quad 0.0958 \quad 0.0701]$$

$$B_2 = [0.1429\ 0.8571] \circ \begin{bmatrix} 0.3 & 0.7 & 0 & 0 \\ 0 & 0.1 & 0.9 & 0 \end{bmatrix} = [0.1250 \quad 0.1250 \quad 0.7500 \quad 0]$$

$$B_3 = [0.0598\ 0.3488\ 0.0893\ 0.5021] \circ \begin{bmatrix} 0.1677 & 0.8333 & 0 & 0 \\ 0.5312 & 0.4688 & 0 & 0 \\ 0 & 0.6000 & 0.4000 & 0 \\ 0 & 0 & 0.6000 & 0.4000 \end{bmatrix}$$

$$= [0.2180 \quad 0.2180 \quad 0.3140 \quad 0.2500]$$

$$B_4 = [0.1111\ 0.8889] \circ \begin{bmatrix} 0 & 0.7 & 0.3 & 0 \\ 0 & 0 & 0.7 & 0.3 \end{bmatrix} = [0 \ \ 0.1000 \ \ 0.6300 \ \ 0.2700]$$

According to formula (7), the result of comprehensive evaluation is as below.

$$B = [0.0779\ 0.2719\ 0.6026\ 0.0476] \circ \begin{bmatrix} 0.4661 & 0.3680 & 0.0958 & 0.0701 \\ 0.1250 & 0.1250 & 0.7500 & 0 \\ 0.2180 & 0.2180 & 0.3140 & 0.2500 \\ 0 & 0.1000 & 0.6300 & 0.2700 \end{bmatrix}$$

$$= [0.2180 \quad 0.2180 \quad 0.3140 \quad 0.2500]$$

According to the principle of maximum membership degree, it can be determined that the risk of the overhead transmission line project in the coal mining infection zone is class III, that is, the risk is common.

5. CONCLUSION

To sum up, although there is a high geological risk in study area, the overall risk is moderate and under control. The reason is that measures to prevent goaf and to maintain and strengthen transmission line have been implemented quite well in this area. As for weight of index, the weight for stability of goaf is the maximum, and the one for hydrological factors is the second maximum. Therefore, in order to reasonably control the risk of overhead transmission line project in coal mining infection zone, not only predictable prevention measures for hydrological conditions but also a series of mining protection ones are necessary. Finally, we propose the following suggestions.

IMPROVE COAL MINING METHODS

Make the traditional single longwall mining shift into an integrated mining by combining several mining modes. Especially in the area where overlaying strata is prone to collapse, multi-layer layout mining, harmonized mining and strip mining should be used so to lower the negative influence on transmission line project while ensuring the mining operation can be completed on time.

ENHANCE MEASURES TO MAINTAIN AND STRENGTHEN TRANSMISSION LINE

For new transmission line projects in existing mining zone, to reasonably set up tower base and make a construction plan, mining plan and mining mode should be taken into account at the same time. The selected location of tower base should be in the backfilled mining zone and far away from mining operation area. In a mining zone covered by existing power transmission projects, measures to maintain and strengthen transmission line project should be enhanced by regularly inspecting transmission line's operation and setting up on-line monitoring devices.

IMPROVE COAL MINING PLAN

According to the progress of existing transmission line project, we can control mining plan to avoid mining and operating the transmission line project at same time, and ensure we can exploit in the area where there are few tower bases at the beginning of mining, and where there are a lot of tower bases at last stage of mining. Especially at the last stage of mining, we should take opinions from experts in various fields to make mining plan to ensure both the utility industry and mining industry running regularly, and to make the economic and social loss down to the minimum.

ENHANCE MINING PREVENTION MEASURES

For the land mined, we should fill collapses and cracks in time. For seasonal precipitation, we should prevent and drain water in time. As for mountain which is prone to occurring landslides and debris flow, we shall take measures to make it solid.

If the collapses affect the normal operation of the transmission line, go and contact professionals in time to recover it after mining.

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The Modern Hotel Operating Mode under the Condition of Network Times

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Abstract: Social impact of the Internet age of today is growing, Its impact on the modern mode of operation of the hotel industry cannot be ignored is the reality. Hence the modern hotel business model showing the main features of eight areas: As an important resource of information has led to the modern property management operation full of vigor and vitality; Hotel operations Process Reengineering (BPR) will form the hotel's competitive advantage at a higher level; New Internet technologies for the hotel updated philosophy; Make use of network technology to establish the image of the hotel have more room; Internet marketing will bring good results Hotel; For the hotel business management network is a revolution; Competition Network Times Hotel is competition between hotel itself as the core of supply chains; Internet age hotel personnel quality requirements are getting higher and higher.
Keyword: Internet Age; modern hotels; business model

1. INFORMATION AS AN IMPORTANT RESOURCES WHICH HAS MADE MODERN HOTEL INFORMATION RESOURCES MANAGEMENT IS FULL OF VIGOR AND VITALITY

The emergence and development of the Internet is constantly changing the world, also affecting and changing people's lives. For the hotel, the Internet for the hotel industry both challenges, but also brought opportunities for development. Can be said that the impact of the Internet is a double edged sword, able to grasp the opportunity of the hotel will be able to get the opportunity, but cannot grasp the opportunity of the hotel will be a hit or trauma. Social impact of the Internet age of today is growing, Its impact on the modern mode of operation of the hotel industry cannot be ignored is the reality. Therefore, under the Network Times to Probe modern hotel business model will undoubtedly have great practical significance for the industry concerned[1].

Previous hotel enterprise operation and management in the economy is not developed early or the market economy, the resource is not abundant enough, the hotel's central task is mainly to collect resources to ensure the benign operation. The main resource of traditional hotel is people, goods, and customers. In today's Internet age, as the material basis of tourism and hotel industry become gradually rich, more and more hotel enterprises face the international competition domestic zed, domestic competition in WTO "the globalization of market competition. They have deeply realized in hotel operation and management of enterprise activities, not only there are people under the manipulation of the material flow and cash flow, the more there is a Information flow. Information has become another resources of customers which independent of man, material, capital resources, hotel facilities..It not only over the whole hotel within each organization and function, but also throughout the hotel, such as food raw materials, equipment(such as computer system suppliers)and hotel product (such as guest room, restaurant, recreation, etc.) of dealers (such as travel, booking center, business agents, airlines, etc.). Information is one of the important resources to create wealth, which has become the consensus of the hotel operation and management personnel.

Since information as an important resource, which inevitably produce hotel information resources management? The so-called hotel information which should be processed finish, understood and knew by people, and the hotel management has important application value of data and information. The hotel Information management is that according to the needs of the operation and management, the hotel with certain procedures and methods to collect information through processing and finishing, to assist the management of the hotel to make decisions. Through creative development and utilization of information technology, for effective management information resource of the hotel, which l has become a new source of business growth under the overall operation[2].

2. HOTEL OPERATION PROCESS REENGINEERING (BRP) wills FORM COMPETITIVE ADVANTAGE of THE HOTEL in A HIGHER LEVEL

The Internet age, the market environment has been fundamental changes have taken place. Customer demand is ever-changing in a blink, technological innovation is accelerating, shorten the production cycle (e.g., theme), increasingly fierce competition in the market, these make up the influence of modern enterprise, including the hotel survival and development of three kinds of power: customer, competition and change. As a result, people mission of the enterprise (hotel), the enterprise (hotel) the

foundation of success and a new understanding. That is: the hotel enterprise's mission is to create value for customers, and practical for customers to create value is the process of hotel enterprise, hotel business success comes from the excellent process performance, excellent process performance need excellent process management.

Enterprise business process reengineering (BRP) was first put forward by Michael Hammer and Jame Chamy P, a kind of management thought reached the prime in the 1990 s. It emphasizes the object and the business process as the center, to care about customer needs and satisfaction as the goal, the existing business process is the fundamental rethinking and radical redesign, using advanced manufacturing technology, information technology and modern management means, maximize the realization technology of functional integration, function integration and management to break the traditional functional organization structure, to establish a new type of the process of organization structure, so as to realize enterprise management in the cost of the improvement of the quality, service and speed, etc. Its restructuring mode is that process centered break pyramid organization structure, make the enterprise can adapt to the high efficiency and fast rhythm of the information society, which is suitable for enterprise employees to participate in enterprise management, enterprise internal effective communication up and down or so, has strong strain capacity and large flexibility, make the enterprise production, operation and management ability and level to get better[3].

3. THE USE of NETWORK TECHNOLOGY BRINGS THE RENEWAL of MANAGEMENT CONCEPT to THE HOTEL

Network, the use of this new technology, gives people the biggest shift is the transition of the management idea. In the Internet age, the management idea of people will have the further extension of the following ways:

In terms of the operation time, network (Internet) runs for operation 24 hours a day, working in the basic economic activities on the net is not restricted by time factor, and can be all-weather continuous. In terms of the operating room, network (Internet) turned the world into a "global village", make people's space distance irrelevant, the expansion of economic activity has a global, the hotel industry with the international first-class hotel standard, greatly speed up the process of world hotel industry interdependence unprecedented strengthening. From the hotel's survival way, the network economy era is the era of competition and cooperation coexist, network (Internet) has broken the traditional economic marginal. Information network spread the competition and cooperation between the hotel and also lead to speed up the transformation between competition and cooperation, cooperation in competition or cooperation competition, enhances the vitality of hotel, improves strain capacity .From the principle of management, the Internet age is the age of information and knowledge. Network has broken the original hotel supplies, customers and even information monopoly, to hotels and travel agencies (or scenic spots, etc.) many people (including customers and consumer segment) all can in a fair and open market to make a profit under the rules of the game. From the hotel's business strategy, the hotel will turn industrial economy era of service economy “vertical integration” to “horizontal integration”. Hotel will attach great importance to the development and suppliers (such as business/tourism/conference reservation online customer market and intermediary company, etc.), the seller (such as travel agencies, airlines, etc.) of strategic alliance, attaches great importance to the use of social resources, focus on cultivating and improving core competition force the hotel's own market.

4. THE USE of NETWORK TECHNOLOGY MAKES THE IMAGE of THE HOTEL has MORE SPACE to PLAY

Confined to the traditional advertising media and cost constraints, coupled with the hotel and general industrial enterprise in the market consumption flow to different (regional industrial enterprises in liquid products and consumer trend, however the hotel product illiquid and consumers beyond the trend), although some hotel spend vast sums of money on advertising, but it's not significant. Because the realization of the hotel product purchase are more random. And the network times provides a great opportunity for the hotel the propaganda, the hotel should set up their own enterprise website quickly, promote their own image and product on the Internet. Not only that, the network also provides the hotel with international propaganda media, the hotel can set up the international image of product, brand and enterprise itself. Hotel rapidly through the network of information are feedback and booking. The Internet link to the hotel to create a truly international network, the hotel can know the latest market dynamics, to participate in various international trade organization, international communication, establish a broad customer base[4].

5. THE NETWORK MARKETING will BRING GOOD BENEFITS to THE HOTEL

The way of network to promote the change of marketing mode of modern hotel are various, mainly manifested in the following aspects:

Enlarge the propaganda of the hotel enterprise image, improve customer service measures. The hotel to get the market, first must to introduce themselves service products to market. In the fierce market competition, each new partners (travel agencies, etc.), including customer consumer groups, not only to observe and experience of hotel product quality, but also to

inspect hotel operations, including service characteristics, management mode, management style and market brands and other comprehensive ability. The Internet with its interactive, real-time, concealment and characteristics of large capacity has become the hotel the best carrier for marketing. It raised a more efficient way than ever to build relationships with customers; the most detailed answer can be made to the customer's problem. In consumers' product (service) quality requirements more and more high, the hotel in the international clients within the scope of a growing number of cases, the hotel also only use the Internet to establish or deepen the instant accept the opinions of the customer information feedback system, with partners to establish a flexible, rapid information exchange system, to improve the level of service to customers, in order to attract new customers, retain old customers.

Simplified the way to trade about the hotel with the relevant enterprises, suppliers, distributors, agents) between the way to trade. Network can establish new business relationship between business partners, and through the network to realize electronic trade (commerce), procurement, sales and the exchange of goods (such as hotel supplies recycling).If the hotel set up his own web site, its agents, dealers can access the hotel website, online information query, online booking and online information communication, can range from the product information, booking processing to the payment confirmation, to complete a full set of business processes. Agents can place orders on the Internet, and to be confirmed.

Rapid collection about hotel market information. In the future market, change will be more and more rapidly and uncertainty, in order to adapt to the changes in the environment, the hotel will set up own information system based on the Internet this new platform, so the hotel can obtain the real-time, reliable market demand information. On the one hand, the Internet can be used to make relevant enterprises throughout the world, each other to provide valuable business information; on the other hand, one of the important link of marketing is to fully grasp the government policies and regulations of the target market area .With Internet convenient place can connect with the local government, so as to get the latest government regulations and economic policies [5].

To further reduce the cost of hotel operation. The traditional mode of economic hotel has no direct communication between customers; the information asymmetry will cause waste of hotel operations. Because there is no cost of business operation is excess demand, rather than create value. Network era hotel and its operators should know what customers need, when customers need to. Which can save link, reduce duplication of work. For example, in hotel guest room sales, if the hotel can propaganda and accept the reservation via the Internet, so the hotel don't have to set up a sales office or agency in its customers target market, as long as to establish the relationship between the "win-win" and use their own sales channels with local agents, the hotel can enter the local market, maybe the effect will be better.

6. THE NETWORK is A REVOLUTION for HOTEL MANAGEMENT

Firstly, the Internet has changed the hotel management group, crisscrossed the computer network has changed the way information, which made hotel organization from pyramid to flat. Original upload issued role of intermediary organization gradually disappear, senior policymakers can directly contact with executives at the grass-roots level. By this way the hotel will not only reduce the possibility of some mistakes, but also can improve the working efficiency greatly. Secondly, the network can enhance management functions. Modern computer information network make the enterprise information management system (ERP), customer relationship management (G R M) is becoming a strategic means of hotel management. Its function is not simply to improve the efficiency of management, but also through the management of scientific, democratization and rationalization, strengthen the function of hotel management in an all-round way [6].

Network technology can be replaced by artificial means in whole or in part in the activities and business functions, promoting service, operation and management automation of the process, to improve efficiency and reduce cost. Such as human resource management, guest history file management, the VIP club reward system, material inventory computerized, accounting computerization, etc. Network technology is used to establish local area network within the hotel, each department, each post network at any time will be a variety of data input, immediately which can generate the required report, reflects the relevant issues, so that the hotel management can get adjustments correctly and quickly. From "computerized" to "digital" is the information technology applied in the early stages of the hotel. From the current information technology application of hotel, part of the hotel has entered the network economy era in different degrees of the primary stage, on behalf of the hotel's future development, one of the six major mainstream modes of "E" which is more a representative of the typical hotel."E" hotel simply is the product of digital, networked, intelligent, virtualization as a result, such as the application of electronic commerce, Internet access business rooms, no spoon door lock system, public area light automatic induction system and so on.

7. IN THE INTERNET TIMES, THE COMPETITION of HOTEL isTHE HOTEL ITSELF as THE CORE of COMPETITION BETWEEN SUPPLY CHAINS

Information economics theory, under the condition of information economy, the influence of the basic elements of hotel operations function is not only capital, technology and labor, and information. Necessary information will seriously affect the stability and long-term of the hotel management. Therefore, in the network economy era, the most important link with the enterprise management is the hotel information management. For the hotel, the information management is capturing the new technical and business information , then whose distribution can help the hotel to achieve abundant output and characteristic products in the short term, in order to accepting the rapidly changing global market. In particular, the network will make the hotel competition changed in the following five aspects:

The network competition weakens the decisive role of the industrial economy era enterprises (hotel) strength .The law of the market competition is no longer big fish eating small fish, so the reality is fast fish eating slow fish, and wise fish eat all the fish. The decisive factor of gaining a competitive advantage is the market adaptability of the enterprise (hotel) instead of the strength of the determinants of problem .The hotel that can meet the market quickly, satisfy the personalized needs of customers will be able to have a foothold in the world.

The competition between the hotel has is not only the hotel itself and the peers, but also the hotel itself as the core of market supply chain - from such a complete market competition between supply chains like the supplier's supplier to the customer's customer This isn't just for the competition of scope problem, but the level of the competition. Market supply chain is around the core enterprise (hotel), and it unites supplier, producer (kitchen), the seller (restaurant) until the end user (customer) together as a whole function network structure model, which is through the control of information flow, logistics and capital. For example, starting from the procurement of raw materials (such as food raw material), making into intermediate products and final products (e.g., food), and finally sending the products to consumers' hands by the sales network (such as restaurants).Including all join node enterprise, it is a wider hotel enterprise structure model that starts from the supply of raw materials, through a chain of different enterprises (department) processing [7]

And sales process until the end user. Hotel, it is not only a connection between supplier and the customer's material chain, information chain, capital chain, but also it is a value-added chain, because materials (i.e., hotel product) increase its value on the supply chain for processing and services etc, which benefit related businesses (department).Supply chain is emphasized in the chain of each enterprise strategic partnership. Because of the establishment of strategic partnership, the hotel can work more effectively with the supplier (such as full with tourism team/local guide travel agency) and customers.

At present, domestic hotel enterprises appears to be a whole in the procurement organization (supplies), operations, and marketing. However, because of lacking systematic and comprehensive, hotel operation mode has been unable to meet the needs of the new market development model. he concept of "supply chain" line across the hotel's traditional market, which is from establishment cooperation parties or the new thinking of strategic partnership; starting from the product the source of the lifeline to the end of the product consumer market; Viewing product competitive force from the global and the overall point, so the supply chain is made from an operational competitive tool rising to a method of management system. Through the transformation and integration of business processes, Supply chain management who use modern information technology establish collaborative business partnership with suppliers and customers, the implementation of e-commerce, which can greatly improve the competitiveness of the hotel in order to consolidate the hotel in an impregnable position in the complex market environment.

The Internet has changed the forms of contract between hotels and travel agencies and other agents. Accurate, timely exchange of information make the contract stability enhanced between the hotel and partners so as to further strengthen the contract management of the hotel product sales.[8]

The network is not only providing the customer and the hotel provides with more opportunities to exploit the sales market, but also improving the friendlier flow of information place in order to improve the hotel's ability to understand and grasp the market.

The network has promoted the hotel to developing new products and the ability to provide innovative services. Network makes that hotel can quickly understand the consumer preferences as well as needs, and the demands of consumers can be timely feedback to policy makers, which can promote the hotel to doing new product research and development capabilities for consumers

8. THE INTERNET TIMES has BECOME MORE and MORE HIGH DEMAND for HOTEL TALENT QUALITY

With the development of the modern hotel and upgrading of products, the quality requirements for its practitioners are different. Modern hotel’s whole operations and system operation will need the multi-discipline penetrating into each other, which will require the hotel staff, especially the high-level management personnel, should not only master the single operation skill or technique, but also be familiar with the related technical knowledge in addition to having the innovation consciousness. Hotel, therefore, should introduce both high-quality talents and strengthen job training, which can tap potential from the existing talents and improve the

quality [9].

In the Internet era, the modern hotel management must in accordance with the requirement of the era, the hotel's market positioning, characteristics and operating rules. According to the social requirements reflected by the market, taking advantage of various resources, especially the network resources, will achieve their goals in different periods of the hotel management, constantly adapt to market changes and meet the need of society. At the same time, hotel should ensure its own development as well as obtain the interests .And all this still depends on a number of highly qualified personnel and operation team in hotel.

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Research on"Internet + entrepreneurship Education in Colleges and Universities" Model

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Abstract: To foster innovation entrepreneurship education is the inevitable requirement of higher education teaching reform, promote the teaching reform, is the key to deepen teaching reform, but the essence of education reform lies in the innovation of education. With the further development of Internet, The combination of network and entrepreneurship education in colleges and universities presents new characteristics, colleges and universities should fully study the new background of the Internet, make good use of Internet era new achievements, absorb its advantage, appropriately adjust and develop trategy and the path of entrepreneurship education appropriate adjustment and development, which will become the new gripper of entrepreneurship education in colleges and universities. Through the establishment of long-term mechanism, entrepreneurship education in universities can become more feasible, practical and effective. This article is based on this, puts forward with that we can use of network platform, constantly promote entrepreneurship education reform, explore the new path of entrepreneurship education, build a long-term mechanism of entrepreneurship education, so as to realize the goals of entrepreneurship education in colleges and universities.

Keywords: colleges and universities, Internet +, entrepreneurship education, model

1. INTRODUCTION

In recent years, the college students entrepreneurial work has aroused widespread attention of the society, and has become a focus in the national life. Entrepreneurship courses help students set up career consciousness, obtain the entrepreneurial knowledge and exercise entrepreneurial ability and is universities to conduct entrepreneurship education and basic way of the transmission of entrepreneurial talent to the society. The core of entrepreneurship education in colleges and universities is to cultivate students creative thinking, the pioneering consciousness, spirit, entrepreneurial knowledge and entrepreneurial skills, especially with the deepening of the wave of technological innovation and the development of economic globalization, the cultivation of innovative entrepreneurial talent has become the consensus of the mainstream in today's world. Around the central ministries and commissions such as the ministry of education and local government have issued a series of encourages and supports college students entrepreneurship policy incentives and support the college students' entrepreneurship in deep-going way. College students' entrepreneurship education, directly put forward innovative talents training target, gradually be taken seriously, also has become China's reform of higher education, change the talent training mode, the important measures to improve the quality of higher education.

Although in the entrepreneurship education in China's colleges and universities, but the interactive and practical obviously is deficiencies, and ignored the role of the Internet platform. With the rapid development of computer technology and network technology, the construction of hardware and software platform, the use of network platform, autonomy, virtual, interactive, and other functions for college students in network teaching, online discussions, network consulting, network propaganda, entrepreneurship education for college students in the teaching and management, the knowledge theory of entrepreneurship into operable teaching practice, should college students is very good in all sorts of problems encountered in the entrepreneurial process, to better cultivate college students' entrepreneurship and entrepreneurial skills.

1.1 Research Review

Entrepreneurship education in colleges and universities has important strategic significance to improve the independent innovation ability and build an innovation-oriented country. Entrepreneurship education in colleges and universities need to have a perfect and normative education system, in order to ensure the smooth realization of the goal of colleges and universities entrepreneurship education. Since 1998, many universities have set up the entrepreneurship research and education center in China, to conduct entrepreneurship education and research work, in the courses in entrepreneurship, explored the teaching method of entrepreneurship and entrepreneurial management research has achieved some results. But just to carry out the entrepreneurship education in colleges and universities, there is less class hour, not clear enough to interpretation of entrepreneurship to the student, so under today's the background of Popular entrepreneurship and innovation, in the classroom as the center of the traditional offline entrepreneurship education model have been unable to meet the needs

of today's business.

Some scholars have put forward the organic integration of Internet and education, the optimization and allocation of education resources, to enhance the level of education and learning effect, but there is little "Internet + entrepreneurship education in colleges and universities" platform, also did not form a set of effective way to solve many the entrepreneurship education problems, such as the discovery of business opportunities, to form a team, business, and so on.

In fact, "Internet + entrepreneurship education in colleges and universities" mode, refers to using the Internet platform, entrepreneurship education of each subject, links, content, templates to form the organic combination of paradigm, implement and is a kind of method to improve the level of entrepreneurship education in colleges and universities in the Internet under the premise of the rapid development, to achieve the entrepreneurship education in colleges and universities. It is a complete system of all aspects of organic combination, the existing research has failed to provide a platform to the organic link and through entrepreneurship education profile. Based on this, this article put forward: Using Internet platform to carry out the entrepreneurship education in colleges and universities and education itself, using the Internet to deconstruct the traditional learning mode and education system, and redesign a new interactive teaching and learning mode, introduce the latest entrepreneurship education resources to the first class of entrepreneurial education and entrepreneurship of the second classroom practice, combing resources take the initiative to meet the needs of students. By two aspects of mutual cooperation from mentors and entrepreneurship students, students self creativity and initiative into full play. Under the condition of the Internet, students can make use of network resources to carry out the education itself, on the one hand, the use of integration of online resources for learning, on the other hand, use the platform of the network, and carry out entrepreneurship education practice, so as to build a set of "Internet + entrepreneurship education in colleges and universities" platform. From the dynamic adjustment of curriculum design and the optimization of system technology, the enhancement of process and interactive curriculum resources, the introduction of flexible open management technology, the use of material resources, based on the entrepreneurial process enhancement visualization and humanization of curriculum resources, provide a dynamic adjustment of online entrepreneurship education mode and entrepreneurial learning environment adaptability for college students .So as to realize both fit The Times, and suit students reality, 3 d, more mining, attractive entrepreneurship teaching and individual way.

1.2 Deepen The College Students' Entrepreneurship Education Significance And Value

(1)Accords with the practice of entrepreneurship education in colleges and universities, which is beneficial to form a distinctive pattern of entrepreneurship education

College students' entrepreneurship education has been one of the leading enterprises in the domestic work, accumulated a certain entrepreneurial education experience. Subject of entrepreneurship education in colleges and universities pattern compared with the traditional model of entrepreneurship education, emphasized based on the Internet platform, by both teachers and students cooperate with each other, play to students' self creative and initiative, is the system, a comprehensive range of entrepreneurship education, with distinctive features.

"Internet + entrepreneurship education in colleges and universities", which is beneficial to improve college students' entrepreneurship and entrepreneurship

Rate of domestic college students entrepreneurship, entrepreneurial success in one area is different from that of western developed countries, highlights the lack of college students' entrepreneurship and entrepreneurial spirit in our country. "Internet + entrepreneurship education in colleges and universities" mode, emphasize the personal cultivation, the whole society to participate in, to create a good atmosphere of entrepreneurship education, and enhance college students' entrepreneurial ability and entrepreneurship.

1.3 Research Target

Revealling the law of fusion between the Internet and the entrepreneurship education in colleges and universities. On the one hand, the use of integration of online resources for learning, on the other hand based on network platform, form the interaction between teachers and students, exert self creativity and initiative, providing students with practical opportunities, gain real experience in different positions, to help students grasp the whole business and accumulated valuable experience, so as to shorten the entrepreneurship of the students "growth", in line with the actual requirements of the development of entrepreneurship education today, lay solid foundation for the business.

To build "Internet + entrepreneurship education in colleges and universities" platform. To carry out the remote education undertaking at any time through the network, which to make the students accept entrepreneurship education via the Internet is not restricted by time and place, thereby saving a lot of time, more convenient and efficient to solve students problems in the process of business practice.

To promote entrepreneurship practice, improve the college students' entrepreneurship training mechanism, causes the student to exercise in the entrepreneurial practice the basic literacy needed.

1.4 Innovation

（1）To build entrepreneurship education mode in colleges and universities from the perspective of the Internet

"Internet + entrepreneurship education in colleges and universities", major changes to the traditional entrepreneurship education. For learners, and can realize entrepreneurship education is not restricted by time, place and space, meet the demand of students of the differences between professional and personalized; Through the Internet this platform, the system and comprehensive for entrepreneurial education to build a stable channel of communication, the students with entrepreneurial ideas, gather together, are more likely to acquire knowledge, and elasticity, which is conducive for entrepreneurship education work in colleges and universities to spread effectively.

（2）Build online to online interactive teaching mode. Traditional offline entrepreneurship education mode limits the amount of information of students, through the Internet, let the entrepreneurship education in colleges and universities to realize online and online simultaneously, and can meet the student to carry on the review on two or more. To use the "Internet + entrepreneurship education in colleges and universities" platform, achieving the synchronization dialogue between successful entrepreneurs and entrepreneurial intention of college students, providing creative college students free guidance, conveying the latest industry information and seek their own business partners, exploring college students valuable ideas.

2. THE INEVITABILITY OF "INTERNET + ENTREPRENEURSHIP EDUCATION IN COLLEGES AND UNIVERSITIES"

Internet scale rapid development, has become key areas of strengthen entrepreneurship education in colleges and universities and entrepreneurship practice. Xi jinping (2013) pointed out that the whole society to attach importance to and support the youth entrepreneurial innovation; Li keqiang approved implement the plan which people club department issued the "college students business plan" in 2014.The entrepreneurship education is quality education in colleges and universities, is each professional must open education, teaching audience the most wide, but from the point of view is efficient to carry out the entrepreneurship education, even fewer hours (up to 32 class down to 16 hours),but entrepreneurship education contents include the discovery of business opportunities, to form a team, business, and many other issues, the existing class time is not enough to clear interpretation business content to students, so under today's the background of Popular entrepreneurship and innovation, in the classroom as the center of the traditional offline entrepreneurship education model have been unable to meet the needs of today's business. Through online entrepreneurship education to make up for the offline entrepreneurship education is an inevitable choice.

"Internet + universities entrepreneurship education different from the traditional" entrepreneurship education curriculum, it has both of the commonness of entrepreneurship education, but also has the particularity of network entrepreneurship education, it can be through online classroom speculative + network interactive training + series entrepreneurship practice, through the implementation of network entrepreneurship education courses, to realize how to cultivate students in innovation, entrepreneurship and entrepreneurial knowledge and entrepreneurial skills two levels increase.

3. TO BUILD THE CONTENT MODULE OF THE "INTERNET + ENTREPRENEURSHIP EDUCATION IN COLLEGES AND UNIVERSITIES"

Designing projectized teaching scheme of entrepreneurship courses(Using the network platform to carry out the entrepreneurship curriculum project teaching basic idea is to use network interactive platform, to create enterprise's process and start-up operation as the main line, according to the actual process of new ventures, gradually points project explanation, practice and ordering the knowledge content, using network platform characteristics of visualization, interaction, etc, so that the students in the learning environment of imulation to better understand and master the ability to create process and every link of enterprise requirements, helping to stimulate students' entrepreneurial enthusiasm and develop their skills),Adopt this way of teaching, embodies the teaching concept of ability standard, realize the goal of knowledge and the diathesis developing targets at the same time. The author believes that "Internet + entrepreneurship education in colleges and universities" mainly includes the theory of entrepreneurship courses + entrepreneurial practice+ entrepreneurial atmosphere + entrepreneurial policy. As shown in Fig. 1.

3.1 Set Up A System Of Entrepreneurship

Colleges and universities should strengthen students consciousness of entrepreneurship education, pay attention to cultivate students' innovative spirit and entrepreneurial ability, especially must pay attention to inspire students entrepreneurial potential. Should vigorously promote entrepreneurship idea, promote the state supports and encourages the policy and countermeasures of entrepreneurship, carry forward the spirit of innovation and entrepreneurial culture, within the scope of the society gradually build respect for entrepreneurship, business identity, desire for entrepreneurship and the social atmosphere of competition to entrepreneurship, enhancement of entrepreneurs "honor" and "pride". Web site provides the lecturer's classic video, well-known experts, entrepreneurs who has extensive industry experience and resources , professional managers, angel

investors and entrepreneurs' views on relevant theories and views, and vigorously promote the information about the success of the college students' entrepreneurship typical demonstration, capital, services, products, manufacturing process and sales ,in some conditions mature can also form a college business alliance, strengthen overall business risk prevention ability. To put the practice of the "Internet + entrepreneurship education in colleges and universities" into effect.

3.2 Build Entrepreneurship Training Modules

The future development of entrepreneurship must form a match with their own actual teaching theory and teaching practice. Entrepreneurship curriculum development is based on curriculum theory, respectively, the theoretical basis of the view of curriculum development and curriculum development based on the working process of the systematic theory, training course development should follow the rules of practice teaching, when combined with entrepreneurial class, also derived perfecting its own theory and practice method, realize the innovation of the entrepreneurial class teaching practice.

Colleges and universities should put the innovative entrepreneurial talent training as the point of general education and professional education. Running enterprise foundation in general education platform, career planning and employment guidance, in the professional education platform for professional introduction, etc required course. At the same time opening innovation entrepreneurship and employment of general education elective module, and the original professional courses education curriculum reform, and required courses to increase innovation entrepreneurship knowledge content [1].

3.3 To Strengthen The Practical Courses, To Project For Traction To Conduct Develop Of Innovation

Entrepreneurship practice basic quality and ability of innovative depends on practical courses is effectively promoted, students' knowledge and experience will be with the development of creative education and constantly deepen and improve. The core carrier of entrepreneurship education in colleges and universities is the college students, thus to look on entrepreneurial projects as guide, project as traction, learning to do, do the middle school, teaching is learning, teachers and students interaction, build knowledge education of college students and independent learning sequence of education practice. Practical courses as the main course of creative education mode, need to take the student as the main body, colleges and universities should be based on a different platform, Strengthen the integration of resources scattered in the campus of the different disciplines and different departments ,In scientific research, the university students of science and technology competition between teachers and students and college students' innovative entrepreneurial training programs for traction, encourage students to carry out inquiry learning, innovative experiment, business simulation and entrepreneurship practice activities, Actively promote synergy and synergy between subjects ,colleges and enterprises, teachers and students together, Comprehensive building "training - practice - actual combat" trinity in stages, thick basis, stessing in practice of education system, So that students in immersive commercial atmosphere to improve actual combat skills, reach to the purpose of inspire - practice -entrepreneurship[1].

3.4 Create A Good Atmosphere Of Entrepreneurship

To carry out "The school business innovation competition", Will students entrepreneurial projects and market docking, linked to the enterprise, seek new pattern of niversity-enterprise cooperation. "To carry out the simulation of entrepreneurial activity," From looking for opportunities to make business plan, build entrepreneurial team, proceed business financing and creative management, to improve students' perceptual knowledge in entrepreneurial process, achieve the goal of practice to learn and improve." To develop series lecture of entrepreneurs", invited alumni and mentors for the student to carry on the experience and knowledge of communication, let students understand the entrepreneurial hardships and persistent motivation.

Schools should pay attention to collect students' entrepreneurship case, including students and graduate student's case, select annual business outstanding talents, build and open "history exhibition," entrepreneurship to set an example for the students. Compared with mentors, these business practitioners experience closer to the student life, a greater role models. Teachers can through interview assignments and homework report of entrepreneurial foundation course, collect the student's case, so as to improve the business case. Through the alumni association and so on platform, School can create offline and online business alumni club, etc., establish entrepreneurial alumni library. Throught holding entrepreneurial alumni seminar or business visit, lets the student in close contact with entrepreneurial alumni, realize the spirit effect of college students' entrepreneurial model .In general, entrepreneurial alumni have more enthusiasm to participate in the activities of the Alma mater, to give back to his Alma mater. Online activities include throught weibo, WeChat establishing entrepreneurial social platform. The online platform has higher participatory, therefore, the effect may be better. By establishing or maintaining these platforms, diversification of adervitise, effectively promoting the entrepreneurial spirit, so that the students in the process close to feel the importance of innovation, practice, and strive to strengthen students' entrepreneurial awareness, encourage students' entrepreneurial behavior [2].

3.5 Improve The Mechanism Of Social Orientation,

To Create A Positive Business Environment

Entrepreneurship is to determine the objective factors of effect of entrepreneurship, create a good environment for innovation entrepreneurship is the government, industries, society and the common responsibility of colleges and universities. Government departments should give full play to its policy guiding and coordinating role, make full use of government financial subsidies, venture funds, risk investment, such as resources, improve the efficiency of entrepreneurship, create a positive business environment, for entrepreneurs to provide the necessary policy and financial support. Industry enterprises and the social from all walks of life should actively build good creative atmosphere and environment, and provide the necessary internship and practice base, actively carry out cooperation of production, study and practice activities. Outside the stimulate entrepreneurial zeal, innovation ability training, colleges and universities should formulate and perfect the encourage and support the college students entrepreneurship policy, pay attention to the establishment of entrepreneurship to the student psychology and guidance, hire a distinguished alumni, business elite and other leading figures in the field of entrepreneurship, innovation and innovation ability, experienced teachers to form tutor team, one-on-one instruction, lead students to seriously study entrepreneurship preferential policies at the national and local government, for real-time policy making and adjustment, to guide students from set out actually, play its advantages of having a wealth of knowledge reserves, actively carry out business activities, to give college students' venture capital support, and help reduce risk in the process of entrepreneurship for college students, little detours, promote entrepreneurship skills and their comprehensive qualities, adapt to the needs of society[3]. Entrepreneurship education content frame is in the Fig. 1.

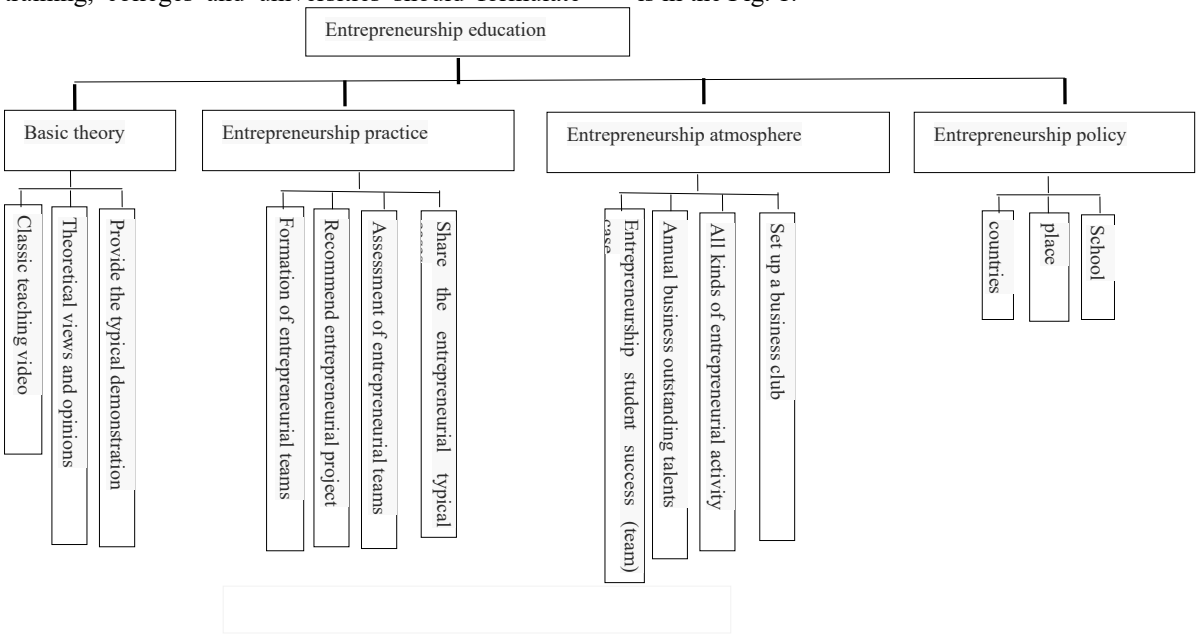

Figure 1 Entrepreneurship education content frame

4. "INTERNET + ENTREPRENEURSHIP EDUCATION IN COLLEGES AND UNIVERSITIES" PLATFORM SYSTEM DESIGN

Entrepreneurship education network platform is the "place" that student conduct online entrepreneurship education study, practice and communication .Students not only can be anywhere at any time to view the entrepreneurship education curriculum content, teaching announcement, teaching video, case teaching, but also can learn problems encountered in the timely through the platform with the teachers and students online communication and discussion, this makes the college students in the process of entrepreneurship education from passive of access to information is converted to active access to information. Through the network of real time and at any time, making the entrepreneurship education across the restricted by time and space and geography of teaching instruction, make the follow-up communication with the guidance of the basic guarantee. At the same time, through the network and other members of your group learned from each other, mutual communication, through the cooperation way to realize information resources sharing, it is convenient for college students' learning and communication anywhere and anytime. In addition, entrepreneurship education network platform can provide a free, flexible, interactive network classroom, teachers can publish video, case of entrepreneurship and entrepreneurial practice process, entrepreneurial policy content on the Internet, students can use the Shared business teaching resources, meet the demand of personalized learning. In addition, students can through entrepreneurship education network platform to provide the download function, access to relevant data and software, so as to solve the problem of shortage of teaching

resources. Therefore, this paper argues that Internet + entrepreneurship education in colleges and universities with a certain color of self-education, is a kind of teaching mode innovation, is also a worth groping, is worth promoting entrepreneurship construction path.

4.1 "INTERNET + ENTREPRENEURSHIP EDUCATION IN COLLEGES AND UNIVERSITIES" PLATFORM STRUCTURE DESIGN

"Internet + entrepreneurship education in colleges and universities" platform structure is based on B/S mode, Fig. 2 is three layer structure diagram which is realized through entrepreneurship education virtual network platform. Front-end client is the presentation layer, unified for the browser interface, application service layer use IIS (Internet Information Server) to publish application such as system management, teaching, practice , the database for data services needed by application service layer to provide the database support[4]

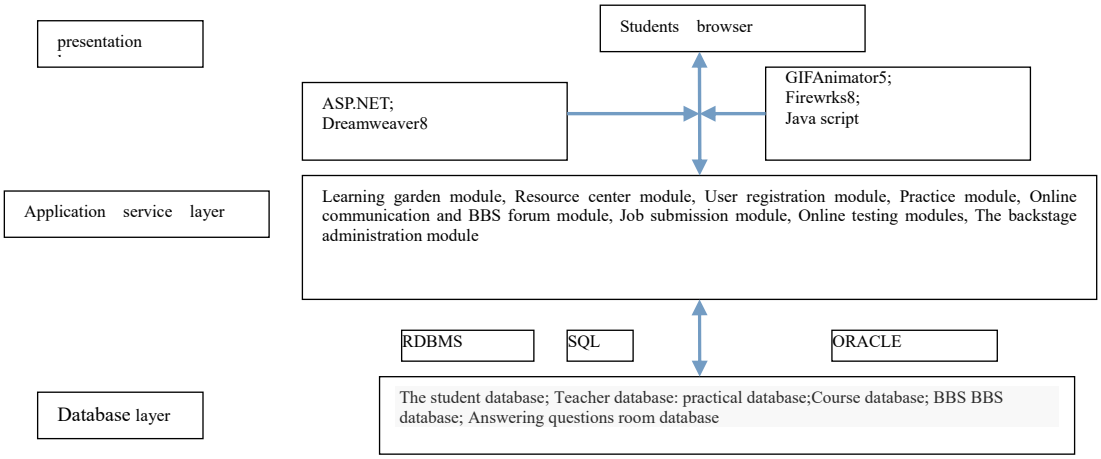

Figure 2 B/S model of three layer structure

4.2 The Function Of Entrepreneurship Education Virtual Network Platform Design

①Learning garden module

Learning garden mainly includes business guide, entrepreneurial skills, business elite, college students' entrepreneurship education related policies and regulations, the theory of entrepreneurship, entrepreneurship practice assignments, successful entrepreneurial putted forward and announcements, course introduction, teacher introduction and other information.

②Resource center module

Mainly includes the teaching video, teaching case, teaching courseware, business plan template, outstanding students entrepreneurial plan cases, students report PPT electronic documents, a set of complete simulation of industrial and commercial tax registration case of a limited liability company information (students through learning this data can master that enterprises running need the previous job content, students can online design simulation and operation), the laws and regulations, etc. Students can watch online video, also can use the teaching courseware for learning.

③User registration module

Before using the network platform, students must be registered. Only registered users can log in the platform for online learning and communication.

④Practice module (have to log in to practice on the Internet).This is the innovation module of the virtual network platform for entrepreneurship education, also is the core part, make up the blank of other entrepreneurship network, is a college student in the pioneering practice must master the knowledge content. We through the accumulation of entrepreneurial education practical teaching for many years, summarizes a set of entrepreneurship practice of knowledge essential to set up new businesses, including venture financing, the choice of the form of new corporate law, business financial planning compiling, industrial and commercial registration process, the method of payment in the bank, tax business practices, business plan (video recording, report), modeling of the network marketing, e-commerce practice such as entrepreneurship education practice. However, because of in the entrepreneurship education by the limitation of teacher resources and so on, can't make more students to receive training. Entrepreneurship education in colleges and universities, therefore, a virtual network platform can make more students through the campus network operate the simulation online entrepreneurship practice, we also provide the operating methods on the Internet and the correct answer.

⑤Online communication and BBS forum module. Teachers can use regular network platform to

communicate with students, students in the business process and the process of entrepreneurial learning if you have problems, you can consult the teacher, we have several teachers can online answering questions at the same time, set the text question, map answering question , video answering question, and other forms; Students can also use the school exchange and discussion, learn from each other; Students can also through the BBS forum exchange experience and entrepreneurial experience, at the same time can post their own entrepreneurial idea, which is for students in joint venture wishes to provide a platform of communication business.

⑥Job submission module

Teachers using the platform, can ask the students' homework. Students can upload finished homework to platform, and teachers can evaluate the students to hand in homework and grade.

⑦Online testing modules

Students can simulate the answer online to inspect study circumstance, to better understand the knowledge. Students online test is completed, the system automatically give score and the correct answer.

⑧The backstage administration module

In order to guarantee the normal operation of the entrepreneurship education network platform, need the support of a powerful background management system. Background management module mainly includes the announcement, students and teachers to upload data management, time management, operation management and related link to the site, dynamic network management, and other functions. At the same time, the background management module requires a higher security level, need identification and authentication for listed user information.

5. THE USE OF "INTERNET + ENTREPRENEURSHIP EDUCATION IN COLLEGES AND UNIVERSITIES" PLATFORM

"Internet + entrepreneurship education in colleges and universities" platform, is not a simple university entrepreneurship education course website, but is the depth of the fusion between the Internet and entrepreneurship education in colleges and universities. Through the organic combination of online and offline, attain the goal of education effectively. Platform using the object: college students or have graduate students in the province. Teachers in the process of teaching entrepreneurship education theory knowledge, can decorate class learning website related content after class; In the process of entrepreneurship practice, students can through the network platform to check the related policy, and through the platform to find business partners, and communicate with each other. Has graduated students can log in at any time browsing and communication platform, as shown in Fig. 3.

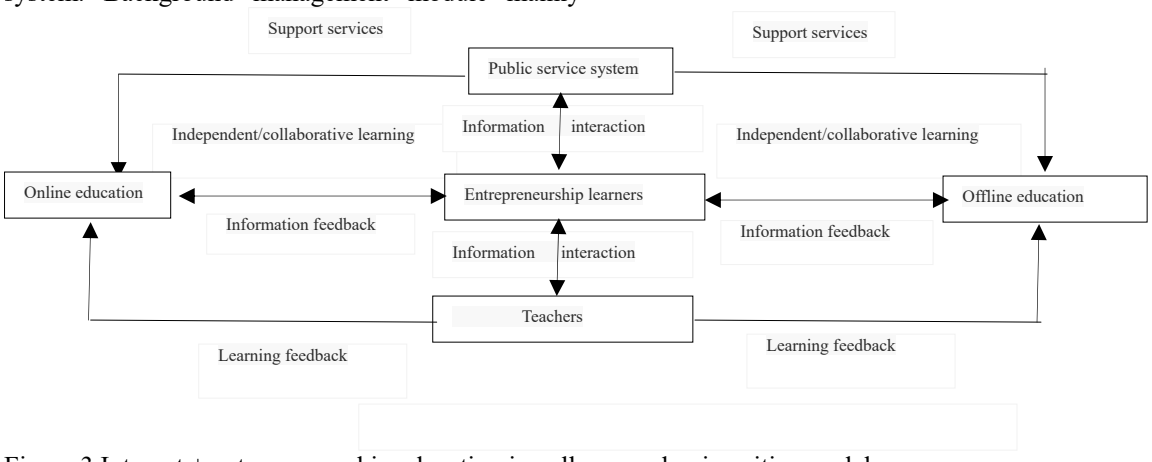

Figure 3 Internet + entrepreneurship education in colleges and universities model

Entrepreneurship education virtual network platform based on the latest Microsoft. NET platform for architecture, using ASP. NET language development, background database use SQL Server 2000, here are the main technology used in this platform ----ASP.NET.

ASP.NET is a dynamic Web application technology. It is part of the.net framework, you can use any. NET compatible language to write ASP.NET application. Using Visual Basic.net, c #, j #, ASP.NET page (Web Forms) to compile can provide better performance than the scripting language. Web Forms allow base on powerful form in Web pages. When set up the page, you can use ASP.NET server controls to establish commonly used In element, and program to complete the task In general. These controls allow the use of a built-in reusable components and custom components to quickly build a Web Form, make the code simple.ASP.NET provides a programming model and structure, compared to the original Web technology, it can more quickly and easily to establish a flexible, safe and stable application, as shown in Fig. 4.

Based on ASP.NET + SQL technology, combined with the HTML WEB pages, ASP.NET instruction and ActiveX components to establish a dynamic, interactive and efficient WEB server application. Platform background is designed by using SQL

technology. SQL language can not only realize database quick search function, at the same time also can realize information sharing, convenient to upgrade platform and exchange information between students. Development of entrepreneurship education network practice platform, it is better than other traditional education practice platform with challenging and realistic competitive, more conducive to the improvement of students entrepreneurial skills and entrepreneurial quality.

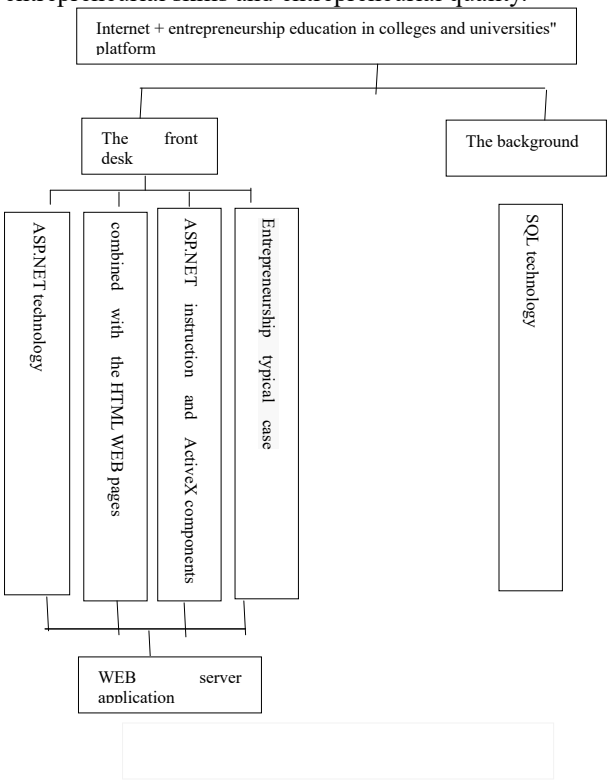

Figure 4 Entrepreneurship education platform application

First of all, the platform design is designed according to the adaptive learning situation, the entire education platform to form a collection, one-to-many knowledge transfer, and has self evolution and function of automatic optimization;

Secondly, colleges and universities entrepreneurship education platform is one of the multi-agent constitute the structural platform on the background of big data era, including data of multi-source heterogeneity and the application of the emerging network technology, realize the "through train" between the network learning environment, ensure that entrepreneurs have opportunities acording to their learning approach, and a new curriculum designed for demand of entrepreneurs;

Again, as far as teaching content and the communication content, to establish an effective problem system based on network, through the barrier-free access, supporting friendly interaction, providing a rich learning tool principle.

In conclusion, the Internet changes constantly promote the further development of entrepreneurship education in colleges and universities, promote the integration of industry, education and economy. Building benign long-time mechanism of entrepreneurship education under the background of mobile Internet, has strategic significance for development path of entrepreneurship education, and promoting entrepreneurship education in colleges and universities validity .The colleges and universities should start with the study of the Internet development, card and identify the pioneering information and resources brought by the Internet , make full use of the latest scientific and technological achievements, target to meet the needs of college students' entrepreneurs to diversification and individuation, realize benign mechanism such as the active research on the Internet - build Internet entrepreneurship education platform - entrepreneurship students - start-ups incubation - startups feedback colleges and universities[5].

6. ACKNOWLEDGMENT

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The Mechanism of Genistein on the Regulation of Bone Metabolism Network

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Abstract: Genistein is an active natural flavonoid, with a variety of biological functions, including tumor prevention, anti-oxidation, anti-proliferation, anti-cancer and anti-osteoporosis. Osteoporosis and its accompany in gosteopenia are recognized as a major public health problem. In the field of oral medicine, osteoporosis has increased the risk of alveolar bone resorption and bone fracture. It not only affects the facial appearance, but also seriously affects the physical and mental health of the patients. Genistein can promote bone cell formation through a variety of ways, increase bone alkaline phosphatase activity and the content of DNA and calcium of bone cells, inhibit the osteoclast differentiation and Play a role in preventing bone loss and osteoporosis. On the basis of the regulation of bone metabolism network, this paper studies the regulation mechanism of genistein on the related factors through the two aspects of osteogenesis and osteoclastic to provide a theoretical basis for the future research.

Keywords: Genistein; bonemetabolism; network regulation

1. THE OSTEOGENESIS of GENISTEIN

1.1 Effects Of Genistein On Proliferation, Differentiation And Mineralization Of Osteoblasts

Osteoporosis is a universal major public health problem which is characterized by low bone mass, deterioration of bone tissues and increased risk of fracture. The most serious result of osteoporosis is the fracture, the comprehensive (inpatient and outpatient) data resources of the Rochester Epidemiology Project indicate that the dramatic increases in the incidence of fractures at many skeletal sites in the elderly that were observed decades ago [1]. Scholars have been exploring the effect of treatment of some drugs for osteoporosis from different angles, but due to the side effects of the treatment process of the existing limited its clinical application, such as bisphosphonates easily lead to osteonecrosis of the jaw (ONJ), hormone replacement therapy (HRT) to increase thrombus, the incidence of prostate cancer and breast cancer disease [2], therefore, the prevention and treatment of osteoporosis with Chinese herbal medicine and its compound preparations has become a hot research topic. Genistein is a kind of active natural flavonoid, which can promote the formation of osteoblasts in many ways, inhibit the differentiation of osteoclast, and it has a wide range of sources and low price. A large number of experimental studies have indicated that the effect of genistein on bone metabolism is not through a single factor, but the network control of multi factors synergy, with the deepening research of this regulatory network is gradually clear. Also in vivo and in vitro experiments confirmed that Genistein can effectively reduce the incidence of breast cancer and prostate cancer, and has a strong inhibitory effect on tyrosine protein kinase, terminate cell cycle and lead to apoptosis. On the basis of the regulation of bone metabolism network, this paper summarized the research status of genistein in the regulation mechanism of bone metabolism.

Alkaline phosphatase is a marker of osteoblast differentiation, Genistein can increase the activity of it and promote the proliferation and differentiation of osteoblasts in MC3T3-E1. HBMSC (human bone marrow mesenchymal stem cells) was observed to differentiate into osteoblasts, Jin Dai and Yalin Li confirmed the proliferation and differentiation of osteoblast and the activity of ALP in a dose and time dependent dose of Genistein (10^{-8}~10^{-5}M) [3].Ono R et al. found that the amount of protein in osteoblasts, the activity of alkaline phosphatase and the content of DNA were significantly increased by the addition of genistein in the culture media. Qing Miao study showed that genistein increased serum Ca and phosphorus, decreased urine Ca and phosphorus excretion and increased bone calcium and phosphorus content [4]. In vivo experiments showed that genistein could increase the diameter and the ratio of cortical bone in the middle tibia of the hyperglycemia mice [5]. Above studies have shown that genistein can improve the content of protein in osteoblast and promote the proliferation and differentiation, while increasing mineral compositions in mice to ensure the supply of inorganic salts in the mineralized process of bone tissue and to increase the bone quality.

1.2 Regulation Of Protein Synthesis By Genistein In Osteoblasts

The effect of the combination of genistein on the gene expression in osteoblastic cells was completely prevented in the presence of cycloheximide, an inhibitor of protein synthesis, and DRB, an inhibitor of transcriptional activity [6]. The stimulatory effect with the combination genistein on the caspase-3 mRNA expression was completely inhibited with culture of cycloheximide, an inhibitor of protein synthesis, or DRB, an inhibitor of transcriptional activity, in osteoclastic cells with or without M-CSF and RANKL [6]. This finding suggests that the effect

with the combination genistein on caspase-3 mRNA expression is involved in protein synthesis and transcription activation in osteoclastic cells. Moreover, [3H]-leucyl-tRNA synthase is the rate limiting enzyme in the cytoplasm of osteoblasts, genistein has been shown to increase [3H]-leucyl-tRNA synthetase activity in the cytosol fraction of osteoblastic cell homogenate. In summary, the effect of genistein on bone metabolism was achieved by regulating transcription and translation, and changing the activity of protein. Estrogen receptors were found in the osteoblasts, and genistein could be combined with the 17βestrogen receptor [7]. The estrogenic compounds of 17β-estradiol and genistein mediate very different actions on osteoblastic cells. While 17β-estradiol may stimulate bone anabolism, in part, by antagonizing TNFα-induced NF-κB activation, genistein not only fails to prevent the cytokin-induced NF-κB activation, but also directly promotes NF-κB activation in MC3T3 cells [8]. Genistein has been shown to bind to estrogen receptors in osteoblastic cells. Moreover, it is possible that genistein can bind to transcriptional proteins, which differ from estrogen receptors, in osteoblastic MC3T3-E1 cells.

1.3Regulation Mechanism Of Genistein On Pth

There was a tendency for enhanced PTHR1 protein expressions in ovariectomized rats that underwent higher dose genistein treatment. Genistein prevents post-menopausal osteoporosis by alleviating mineral loss and PTH impairments. Runx2 playsa key role in the process of osteogenic differentiation, it is the Wnt signaling pathway in regulating osteoblast differentiation downstream target genes, is also located on the top of the gene cascade effect, can control their expression through CIS acting elements bind a number of osteogenic genes. Mclarrenfound that Notch signaling pathways downstream of Hes1 protein and Runx2 interactions, promotes the bone cell specific enhancer activation, so as to promote BMSCs to osteoblastic differentiation [9]. It was speculated that genistein enhanced the interaction between protein Hes1 and RUNX2 in the downstream protein of Notch signaling pathway, and promoted the differentiation of osteoblasts through the increase of circulating PTH concentration. Administration of genistein limits the elevation of serum b-ALP concentration and might promote osteogenesis. PTH and its receptor might participate in the process of genistein mediated osteoporotic-limiting.

PTH played an active role in the process of inducing differentiation of BMSCs into osteoblasts by Notch signaling pathway. The absence of endogenous PTH inhibits the differentiation of BMSCs into osteoblasts [10]. This inhibition may be the down-regulation of Notch signaling pathway by ligand Jagged1 and receptor Notch1. Genistein may regulate circulating PTH mRNA and protein expression level, up regulation of Notch signaling pathway of the ligand Jagged1 and its receptor Notch1 and Hes1 protein, interacted with Runx2and bound into a bone gene cis acting elements regulating their expression and promote bone cell specific enhancer activation and promote BMSCs to osteoblastic differentiation.

In addition, studies have shown that PTH and PGE2 can significantly improve bone tissue glucose consumption and lactate production, promote bone resorption, but Genistein can completely inhibit the role of PTH andPGE2 [11].

1.4 The Regulatory Effect Of Genistein On Bmp2, Smad5 And Runx2 Signaling Pathways

Results from microarray, quantitative real-time RT–PCR, and *BMP2*, *SMAD5*, and *RUNX2* gene siRNAs knock-down confirmed that RUNX2 was the downstream target for Genistein-induced BMP2/SMAD5 osteogenic signaling. It has been reported that BMPs need extracellular collagen matrix to enhance osteoblastic differentiation and osteogenic gene expression.And *RUNX2*/*CBFA1* requires BMP/SMADs signaling to induce osteoblast-specific gene expression [12]. Using pathway-specific microarray analyses, Jin Dai and YalinLi have identified that BMP-dependent SMADs and RUNX2 signaling plays an essential role in Genistein-induced osteoblastic differentiation of hBMSC cultures [3]. It is concluded that Genistein-induced BMP/SMADs/RUNX2 transcriptions may form a synergistic and antagonistic network to drive hBMSC towards osteogenic lineage.

2 INHIBITORY EFFECT of GENISTEIN on OSTEOCLASTS

2.1 Eph/Ephrin Signaling Pathway

RT-PCR showed that ephrin A2, B1, B2and EphA1, A2, A4 can induce osteoclast differentiation and proliferation. Human BMSC (bone marrow stromal cells) have the presence of ephrin ligands and Eph receptors, which was confirmed by Western blotting and immunohistochemistry [13].

2.1.1 EphB4/ephrinB2 bidirectional signal transduction

There is EphB4/ephrinB2 bidirectional signal transduction between osteoclast and osteoblast [14], EphB4/ephrinB2 bidirectional signal transduction in the presence of contact between mature osteoclast and osteoblast precursor cells, the positive signal transduction promotes osteoblast differentiation, while the reverse signal transduction inhibits osteoclast differentiation and bone resorption activity. Cheng Yuan confirmed that genistein could up-regulate the expression of mRNA and protein of EphB4/ephrinB2 in the tibia of osteoporotic mice induced by glucocorticoid. Genistein increased the EphB4/ephrinB2 contentand promoted bone metabolism to move toward the bone.

2.1.2 EphA2/ephrinA2 bidirectional signal transduction

In the initial stage of bone remodeling, EphrinA2, as an early expression moleculesof osteoclasts, can activate the activation of phospholipase Cγ2 to promote the differentiation of osteoclasts, EphrinA2, which is expressed on the surface of osteoclast, promotes the formation of osteoclast by cleavage of the metalloproteinases (MMP). Knockdown EphA2 gene detected the activity of alkaline phosphatase and the expression of Sp7 gene, which confirmed that EphA2could inhibit the osteogenic differentiation by up regulating the activity of RhoA protein [15]. As the EphA2/ephrinA2 on surface of osteoblast and osteoclast, the positive signals and reverse signals received by osteoclasts can promote osteoclast differentiation and accelerate the process of bone resorption [16]. Genistein could down regulate the expression of mRNA and protein of EphA2/ephrinA2 in the tibia of osteoporotic mice induced by glucocorticoid, inhibit the activation of phospholipase Cγ2, MMP cleavage and RhoA activity, thereby inhibiting the differentiation of osteoclast formation and reduction of osteoclast bone resorption.

2.2 Genistein induces osteoclast apoptosis

Gao YH confirmed that genistein can induce the apoptosis of osteoclast by regulating the calcium signaling pathway in osteoclasts [17]. Genistein can also induce the apoptosis of human ovarian cancer cell line and Jurket-T leukemia cells by the action of protein kinase. GRB2 (growth factor receptor binding protein -2) participates in the process of bone resorption by protein tyrosine phosphatase activated tyrosine kinase Src [18]. The strong inhibitory effect of genistein on tyrosine kinase may induce the apoptosis of osteoclasts and inhibit bone resorption. Through the inhibition of calcium channel and tyrosine kinase, genistein induced osteoclast apoptosis, and there was no significant apoptosis in the culture of osteoblast javascript:void(0);[19]. The effect of genistein on apoptosis may be selective, which might be a good assistant potential for the repair of bone damage.

2.3 The Regulation Mechanism Of Reactive Oxygen Species (Ros)

2.3.1 Regulation of ROS Production and Scavenging in Inhibits Osteoclastic by genistein

Osteoclasts are bone-resorbing multinucleated cells formed by the fusion of their mononuclear precursors as monocytes and macrophages. Osteoclast differentiation of precursors can be stimulated by the receptor activator of nuclear factor-κB ligand (RANKL) produced by osteoblasts. It is well known that the binding of RANKL to its receptor induces small nontoxic amounts of reactive oxygen species (ROS) as various growth factors, as well as cytokines, including tumor necrosis factor-α[20].During osteoclast differentiation, ROS is likely to be endogenously produced either by nicotinamide adenine dinucleotide phosphate (NADPH) oxidase (Nox) or as byproducts of the mitochondrial electron transport chain, and the generated ROS is also removed by phase II antioxidant enzymes, such as superoxide dismutase (SOD), catalase and HO-1 [21].Accumulating evidence indicates that ROS are not only dangerous byproducts of cellular metabolism, but also important factors of signaling pathways in various cellular functions, including regulation, apoptosis and differentiation.

2.3.2 The inhibitory effect of Genistein on the translation and activation of Nox1 and the disruption of the mitochondrial electron transport chain system

It has been suggested that ROS-mediated RANKL-induced differentiation of RAW 264.7 cells into osteoclasts occurs through the activation of Nox homologues and the electron transport chain in mitochondria [22]. Dehydrodiconiferyl alcohol (DHCA) reduced the production of pro-inflammatory cytokines (TNF-α, IL-6, IL-1β and CCL2) and mediators (iNOS, COX-2 and ROS) by down-regulating the activity of I-κB kinase andthe DNA binding activity of NF-κB. That means NF-κB/I-κB signaling pathway had a direct correlation with the inhibitory effect of ROS. During osteoclast differentiation from pre-osteoclast RAW 264.7 cells activated by RANKL, genistein can inhibit RANKL-induced inhibitor-κB (I-κB) degradation and nuclear factor-κB (NF-κB) translocation to the nucleus, resulting in the prevention of osteoclast formation [23].

The Guanine nucleotide three phosphatase (GTPase), which is a necessary part of the activation of Nox-1, can lead to the dysfunction of the mitochondria. It has been indicated that genistein controls ROS generation by attenuating Nox1 translation, as well as Nox1activation via the TRAF6/cSrc/PI3k signaling pathway in RANKL-mediated osteoclast differentiation from RAW 264.7 cells [24]. Genistein may inhibit the activity of Nox1, protect the normal function of the mitochondria, reduce the arises of side effects and inhibit the generation of ROS by the NF-kappa B signaling pathway and TRAF6/cSrc/PI3k signaling pathway.

2.3.3 The promoting effect of genistein on ROS and superoxide anion scavenging

It has been suggested phytochemicals have an effect on the chemoprevention and cytoprotection with anti-inflammatory and antioxidant, but NF-κB and Nrf2 are treated as prime molecular targets. Previous studies suggest that the superoxide anions which is generated by RANKL treatment in RAW 264.7 cells may be transformed by SOD into hydrogen peroxide and may be catalyzed into water and oxygen by catalase immediately [25].As a phytochemicals , genistein can also induces the activation of Nrf2 which is the ROS-sensitive nuclear factors that can lead to the nuclear translocation and increase the expression of phase II antioxidant enzyme genes, such as SOD1 and HO-1 in RANKL-treated RAW 264.7 cells [24]. Genistein can inhibit the production

of ROS, accelerate the scavenge of ROS and reduce the content of ROS in the cells, thus inhibiting the differentiation of osteoclasts.

3. CONCLUSION AND PROSPECT

Genistein is a kind of soybean isoflavone which has the properties of estrogen, almost involved in the whole process of bone metabolism, is a promising alternative medicine to inhibit osteoporosis, repair jaw defects, and assist the reconstruction of alveolar bone. In the regulation network of bone metabolism, the regulation of genistein is involved the regulation of osteoblast and osteoclast in proliferation and differentiation, access more mutual communications between the various pathways, forming a complex regulatory network. The effect of genistein on bone metabolism in various regulatory pathways remains to be elucidated. At present, the clinical experiment of genistein is mostly oral administration, and its bioavailability is low, so how to improve its bioavailability is also a hot topic. With the deepening of genistein regulation network of bone metabolism and related functional groups, how to enhance the regulatory of genistein, improve the biological utilization rate, expand the scope of its application, will be the trend of development. The raw material is easy to obtain and the processing costsis lower, so it will be more widely used in the future.

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The Biological Compatibility of Polyetheretherketone Composites

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Abstract: Polyetheretherketone (PEEK) biological composite has good mechanical property and bioactivity, its application in the fields of bone defect repair, trauma repair, and oral fixed prosthesis and planting have got extensive attention of researchers, more and more PEEK biological composite materials to be developed and development. This article makes a summary on the research progress of the biological compatibility of PEEK Composites.
Keywords: PEEK; Composite materials; Implant; Biological activity

1. INTRODUCTION

As a member of the poly (aryl ether ketone) family, PEEK is a kind of special thermal plastic polymer which has the advantages of high strength, high rigidity, corrosion resistance, hydrolysis resistance, good mechanical properties and biological compatibility[1].It has been successfully applied in aerospace, petrochemical, automobile and machinery manufacturing[2].Compared with the titanium, the elastic modulus of PEEK is closer to human cortical bone. PEEK has good ductility capacity and ray semi transmission, so it does not need to be removedor replaced in clinical examination, such as computed tomography (CT), magnetic resonance imaging (MRI), and X-ray. In the 1990s, as a substitute for metal implants, PEEK composite materials are more and more applied in the field of orthopedics and trauma [3]. In 1992, PPEK was first used in dentistry, mainly for manufacturing orthodontic bite sticks, the temporary abutments and healing capsofimplant [4].

2. TYPES of PEEK BIO COMPOSITES

With the subjects such as materials science, modern life science and scale chemical subjectinteractive penetration, rapid progress in nano modification technology, continuous breakthroughs in key technologies such as synthesis and preparation of composite materials and biological modification, the research of peek biomaterials has been rapidly developed, each kind of new PEEK based biological composite materials have appeared and improved the mechanical properties and biological activity of PEEK. Then, the current common medical PEEK composite materials are described.

2.1 Peek Composites Filled With Nanoactive Particles

Filled with different types of nano inorganic particlescan significantly improve the surface activity of PEEK. At present, the commonly used PEEK inorganic fillers mainly include hydroxyapatite (HA), fluorine apatite (FA), nano TiO2.

2.1.1 nano hydroxyapatite peek composite (ha/peek)

Human bone is mainly composed of nano hydroxyapatite and collagen. HA/PEEK composites which prepared by blending HA with PEEK can significantly improve the biological activity of PEEK. The HA/PEEK composite was soaked in simulated body fluid (SBF) for 4 weeks by Yu S and hiscolleagues. The study found that the surface of each composite showed a layer of bone like apatite film, good osteogenic effect and the biological activity increased with the increase of the volume fraction of HA[5].Texture analysis and tensile test were put on 0-50% HA whisker reinforced HA / PEEK composities by Gabriel L C, the results showed that there had strong interface connection between HA whisker and peek matrix, the tensile strength of 10% and 20% HA whiskers reinforced PEEK composites were 90 and 75MPa, similar with longitudinal tensile strength of human cortical bone. So, 10% and 20% HA whiskers reinforced PEEK composites is a department of orthopedics with excellent mechanical properties and biological activity of implant materials[6].

2.1.2 nano fluorine apatite peek composite (fa/peek)

Fluorine ion has antibacterial effect, which can reduce the adhesion of bacteria to the composite materials and the occurrence of inflammation. Fluorine ion in nano fluorine apatite is smaller than hydroxyl in HA, after the substitution of hydroxyl, the crystal structure is more compact than that of HA, improves the stability of the material. Therefore, it is a good choice for the preparation of new medical PEEK composite materials by blending the nanometer level of fluorine apatite crystal with PEEK.

10 cylindrical nano FA/PEEK and PEEK implants were implanted in the mandibular first molar region of 6 dogs, and 3 dogs were randomly executed at 8 and 12 weeks after operation. The results showed that: compared with PEEK, the MAR and BIC values of nano FA/PEEK implants were higher ($P < 0.05$), and the formation and maturity of new bone were faster at 8 and 12 weeks. The study showed that the combination of nano FA/PEEK and bone bed was better, the osteogenic efficiency was good, and it was good for the growth of new bone [7]. The anterior molar region of Beagle dog was implanted with nano FA/PEEK implant which were sand blasting or not

sand blasting, theexperiments show that, the amount of bone volume and trabecular bone in the nano FA/PEEK implants was significantly higher than that in the non-sand blasting group, and the biocompatibility and osteogenic properties were better. It is possible that the size of the nano crystal is reduced and the roughness of the material surface is increased, so that the osteogenic function and the metabolic activity of the osteoblast can be enhanced[8].

2.1.3 nano titanium dioxide peek composite (tio2/peek)

Titanium dioxide has good biocompatibility, bioactivity and hydrophilicity. Nano titanium dioxide PEEK compositeby blending nano TiO2 and PEEK can significantly improve the biological activity of PEEK. Tsou H.K and his colleages carried out TiO2/PEEK and PEEK cell experiments, the results showed that, compared with PEEK, nano TiO2/PEEK had better biocompatibility of osteoblast [9].

The in vivo and in vitro study of nano TiO2/PEEK composite showed that nano TiO2 can promote the cell attachment and new bone regeneration, improved the biological performance of PEEK; The peripheral new bone volume of nano TiO2/PEEK implant was about two times of PEEK. Obviously, nano TiO2 can improve the bone regeneration around implants, and significantly improved the biological activity of PEEK [10].

2.2 Fiber Reinforced Peek Composites

Fiber is a linear material with special size effect, which is only a few microns to tens of microns in diameter. Many kinds of fibers have good affinity with PEEK and can be used to prepare high performance composites with PEEK to improve the elastic modulus, mechanical strength and dimensional stability of PEEK. At present, carbon fiber (CF), glass fiber (GF) is common mixed with PEEK to prepare the composite materials.

2.2.1 CARBON FIBER REINFORCED PEEK COMPOSITE (CFR- PEEK)

The elastic modulus of 30% Carbon fiber reinforced PEEK composites is similar with bone tissue, has been widely applied in the clinicalorthopaedic field. The addition of proper amount of CF can reduce the friction coefficient and wear rate of the material.

CFR- PEEK implants were implanted in themandibular defects of sheep, bone tissue samples were obtained at 8, 12 and 16 weeks after operation. The amount of callus formation at the junction of CFR-PEEK implant and host bone tissue was significantly more than control group, the combination of CFR-PEEK and bone tissue wasfirm. So, CFR-PEEK implant has good osteogenesis efficacy and biocompatibility [11].The CFR-PEEK implant was implanted into the dog's L6-7 intervertebral disc, the results showed that the new bone tissue grew in the small hole of the composite material. So, CFR-PEEK implant had good osteogenesis efficiency [12].

In addition, on the basis of this, some scholars have carried out the surface modification of CFR-PEEK and prepared the titanium / hydroxyapatite coating CFR-PEEK composite(Ti/HA/CFR-PEEK) and copper nickel coating carbon fiber reinforced PEEK composites, and made a research on its performance.

S. Stübinger implanted CFR-PEEK, Ti/CFR-PEEK and Ti/HA/CFR-PEEK implants in sheep pelvis, the results showed that compared with the uncoated CFR-PEEK, Ti/CFR-PEEK or Ti/HA/CFR-PEEK had better biomechanical properties and higher implant bone binding rate [13].

CFR-PEEK was chemically etched by Cr2O3/H2SO4 solution, and then CU/Ni coating CFR-PEEK composite material was prepared by electro less copper plating nickel on the surface of CFR-PEEK. It was found that the C=O bond and the hydrophilic property of CFR-PEEK composites all increased, cranny and some carbon fiber was found on the surface of the composite, and the bond strength increased [14]. When Cu is used as filler, a thin and uniform transfer film was formed on the surface of the material, the wear rate of materials can greatly reduce and the wear resistance improved [15].

2.2.2 glass fiber reinforced peek composite materials (gfr-peek)

Glass fiber has the characteristics of high elastic modulus, high strength, good thermal stability and stability of expansion coefficient. GFR-PEEK composites were prepared by the treatment of glass fiber with PEEK, and the mechanical properties were tested. The results showed that the mechanical properties and impact toughness of the composites were improved [16]. The bonding strength of the glass fiber surface and PEEK was increased after the treatment of the adhesive agent, and the crack caused by the external force was prevented.

2.3 Multiple Blendingpeek Composites

Although the composite materials prepared by blending PEEK and nano- HA or FA can significantly improve their osteogenic activity, but their brittleness is larger, the mechanical properties of the composites are decreased. Addition fluoride ions, carbon fiber or trace element strontium in HA/PEEK composites by the multi blending methodnot only can make up for these shortcomings, but also improve the biological activity of PEEK.

2.3.1 nano fluorinated hydroxyapatite peek composite (n-fha/ peek)

Due to the synergistic effect of nano-FHA crystal and the roughsurface structure, the biological activity of the nano- FHA/PEEK implant was improved. Wang put nano-PEEK FHA/ composite prepared by multiple blending methodin vivo and in vitro studies. The in vitro experiment results showed that the initial cell adhesion and proliferation ability of nano-FHA/PEEK composite was improved and the antibacterial activity was better. Compared with the

smooth group, the alkaline phosphatase activity and mineralization of the rough group were higher, and the osteogenic efficiency was better. In vivo experiments showed that the new bone volume of nano- FHA/PEEK group was significantly higher than that of PEEK group. Thus, the biocompatibility and antibacterial activity of nano- FHA/PEEK composite materials in vitro were improved, and promoteditsosseointegration in vivo, nano-FHA/PEEK composite has potential of application in dental tissue engineering [17].

2.3.2 carbon fiber reinforced peek nano-hydroxyapatite composites (n-ha /cf/ peek)

The leaching solution of n-HA /CF/ PEEK composites with different volume fraction of HA was cultivated with the rat osteoblasts in vitro. Studies have shown that each composite material not only had no cytotoxicity, but had good biocompatibility and osteogenic effect. When the HA mass fraction is 20%, the biological activitywas strongest and expected to become a new type of orthopaedic implants [18].

Untreated, sandblasting, plasma processing of n-HA /CF/ PEEK implants were implanted in six beagle dogs in bilateral mandible of the third and fourth molar alveolar fossa. The results showed that the n-HA /CF/ PEEK composite for blasting and plasma treatment can promote the proliferation and differentiation of MG-63 cells and bone integration, the new bone volume was significantly higher than that of n-HA /CF/ PEEK group[15].Some scholars pointed out that moderate surface roughness can significantly increase cell adhesion and promote the value of alkaline phosphatase (ALP) activity and the formation of the calcium nodules, enhanced the biological activity of n-HA /CF/ PEEK implants[19].

2.3.3 strontium containing hydroxyapatite reinforced peek composites (sr/ha/peek)

Strontium is a biologically active element, which can promote the attachment and mineralization of osteoblasts, reduce the risk of bone fracture. Strontium containing hydroxyapatite was prepared, and then it was blended with PEEK to prepare Sr/HA/PEEK composite materials. The results of mechanical properties test showed that the flexural modulus of the composites with Sr/HA volume fraction of 25% and 30% were 9.6 and 10.6 GP are spectively, and the bending strength were 93.8 and 89.1MPa, which was significantly higher than that of PEEK, so the mechanical properties were excellent. MG-63 cell experiments in simulated body fluid showed that the formation of apatite on the surface of Sr/HA/PEEK composite and cell mineralization were higher than that of HA/PEEK and PEEK. Visible, Sr/HA/PEEK composite material has good mechanical properties and osteogenic efficiency [20].

3. OUTLOOK

Although many excellent properties of PEEK biological composite materials have been prepared, but there are still a certain distance to its widely application in clinical. With the rapid development of CAD/CAM digital processing and 3D printing technology and the breakthrough of biological key technology, more excellent biocompatibility PEEK bio composites prepared by using a variety of modified techniques is hopeful and will be widely used in the field of medical implants to benefit the majority of patients.

4. ACKNOWLEDGEMENT

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A New Collaborative Covered With the Minimum Connected Dominating Set Algorithm

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Abstract: In Ad Hoc sensor network, seeking a MCDS (Minimum Connected Dominating Set) as virtual backbone network of the network in order to reach effective communication of network becomes a hot issue of researchers. MCDS problem is a typical NP-complete problem. Researchers propose a variety of approximation algorithms to construct MCDS. Two-stage through is adopted to construct MCDS, which reaches the best effect. Firstly, a MIS (maximum independent set) is set up, then Steiner tree construction algorithm is applied to add Steiner nodes so as to achieve connection. First of all, this paper proposes an IC-MIS algorithm based on improved collaborative coverage to solve MIS. The selection of dominating points expands to 2-hop neighborhood to 3-hop. Under the condition where full coverage is ensured, overlapping coverage among dominating points decreases and coverage efficiency improves. Then, two types of Steiner tree construction algorithms: improved Kruskal-Steiner tree construction algorithm (IK-ST) and maximum leaf node Steiner tree construction algorithm (ML-ST). IK-ST constructs MIS node to a generating tree through Kruskal algorithm, and then Steiner tree construction is achieved through adding nodes to replace the side. ML-ST algorithm adopts the thought of maximum leaf node tree. Firstly, calculate the weights for every edge according to certain strategy then a steiner tree is generated with merging edges. The experiment has proven that the algorithm proposed in this paper is able to work out smaller-scale CDS.

Keywords: Ad Hoc sensor network, maximum independent set (MIS), minimum connected dominating set (MCDS), Steiner tree, minimum spanning tree

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1. INTRODUCTION

Ad Hoc sensor network is a kind of network characterized by large scale, self-organization and no support by infrastructure[1]. At first, it was widely applied in military field. In recent years, it has been extensively applied in civil and commercial business[2,3]. Due to large scale and self-organization features of network, network can be automatically constructed in a very short time, but excessive ineffective transmission cannot be avoided, and network storm maybe caused easily. Meanwhile, since storage capacity and power resource of network node are limited, the node loses efficacy and further the link fails. The whole network alters. Therefore, constructing a virtual backbone network [4,5,6,7] in Ad Hoc sensor network becomes a favorite research method of researchers. Virtual backbone network can better adapt the changes of network topology and reduce communication overhead of network, which relieve the resource utilization of inconvenience of the network because of its dynamic characteristics. In short, a virtual backbone network is the approximation of the network. So we can easily control the entire network by the virtual backbone network. Research shows that the virtual backbone plays a vital role in wireless Ad Hoc network routing, the broadcast and connected control.

This paper is organized as follows: in the second part, this paper discusses related work of CDS construction; in the third part, network models and some symbol definitions are introduced; in the fourth,the thought and steps of IC-MIS algorithm are described in detail; in the fifth part, IK-ST algorithm and ML-ST algorithm are presented in detail; in the sixth part, we offer relevant experiments to prove the good effect of the algorithm proposed in this paper. Finally, a summary is conducted for the whole paper.

2. NETWORK MODEL, DOMINATING SET AND RELEVANT DEFINITIONS

This section first introduces Ad Hoc sensor network model, and then presents relevant knowledge of dominating set. Finally, definitions of nouns involved are listed.

2.1 Ad Hoc sensor network model

We suppose all nodes in mobile Ad Hoc sensor network are distributed in a two-dimensional plane. Each node owns omnibearing antenna. The communication range of nodes focuses on this node, and the radius is equal to transmission distance R of the node. When transmission distance R of each node is certain, Ad Hoc sensor network may be abstracted as a UDG graph. In UDG graph, G=(V,E) represents Ad Hoc sensor network topology, where V represents vertex set and E represents edge set. Each node has a sole identifier ID. For any node u, $v \in V$. Only when

the distance between u and v is less than R, it is believed that an edge exists in u and v e=(u, v) $\in$ E. Fig.1 shows a simple UDG graph.

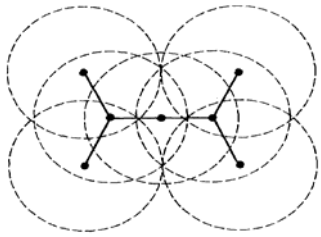


Figure 1 UDG graph

2.2 Related Knowledge Of Dominating Set

In an undirected connected graph G(V,E), V represents vertex set and E represents edge set. If a spanning subgraph G'(V',E') of Graph G meets such condition that any node of G-G' is adjacent to at least a node in V', G' is called a CDS. MIS is also a dominating set. Meanwhile, any two nodes in MIS should have no adjacency relation. In addition, if any node is added, two nodes in MIS have adjacency relation.

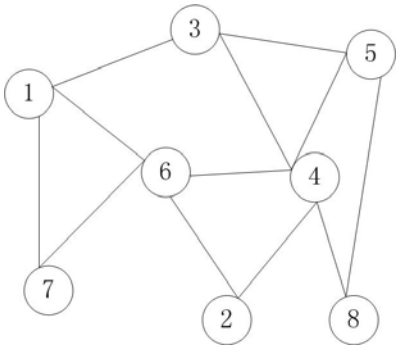


Figure 2 nodes graph

In Fig.2, {5,6}, {3,2,7} and {6,4} are three dominating sets of Graph G, where {5,6} is also called a MIS of Graph G,. {6,4} is called a CDS of Graph G.

2.3 Relevant Definitions

Definition 1

Graph G=(V, E) is a simple undirected graph. It is necessary to meet

Graph G is a connected graph. Meanwhile, an edge at most exists

between any two nodes.

Definition 2

If an edge exists between node u and node v in Graph G, we say node u and node v are adjacent.

Definition 3

In Graph G=(V, E), for any node v, the number of its adjacent nodes is expressed as neighbor node (dergee) Nv of node v.

Definition 4

In Graph G=(V, E), if color status of adjacent node of node v is

current_station, Nv(current_station) means the number of neighbors of

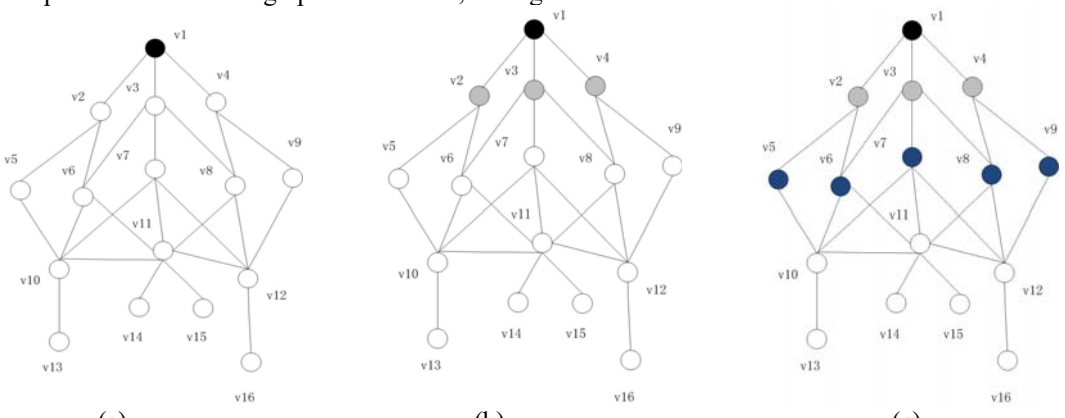
the node v whose color status within one-hop range is current_station.

Definition 5

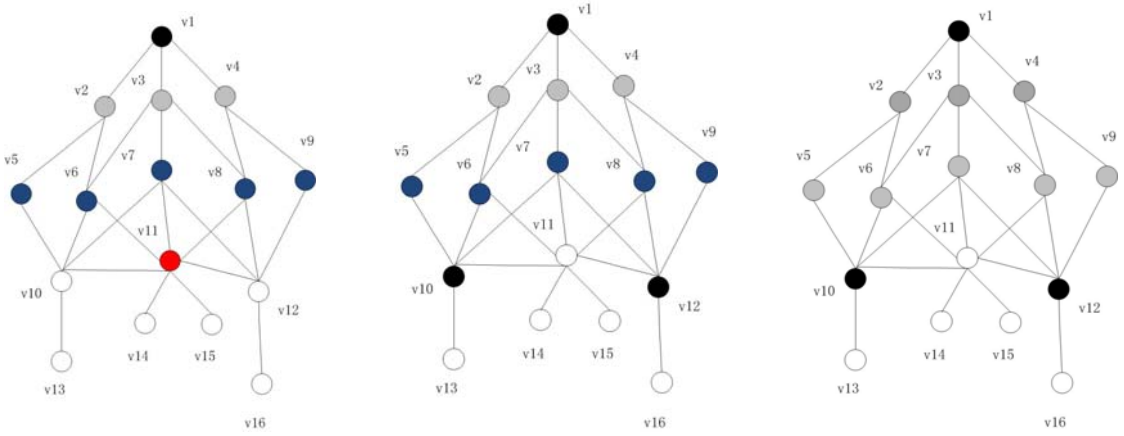
In Graph G=(V, E), Wv=2*Nv(black)+Nv(gray) represents the weight of node, where N(black) represents black neighbors of node v; N(gray) represents gray neighbors of node v. The weight measures whether the node is suitable for serving as the weight of connected node.

3. IC- MIS ALGORITHM

In current stage, many articles propose MIS-based CDS solution algorithm. The algorithm proposed by Rajiv Misra gains the best effect. When the node is considered alone, the coverage is small. Meanwhile, for a connected graph G, when the number of slope surfaces is greater than or equal to 2, at least two covers exist for a connected graph. Hence, this algorithm optimizes the whole MIS through seeking independent set of neighbor node. But, the algorithm chooses the next dominating node from two-hop neighbor of current dominating node. This will cause dominating node coverage has intersection, which reduces coverage efficiency. IC- MIS algorithm preferentially selects the next dominating node from three-hop neighbor of current dominating node. If it does not exist, the next dominating node is chosen from two-hop neighbor of current dominating node to make sets of the coverage as few as possible and increase coverage efficiency. Fig.3 shows an example of IC- MIS algorithm.



(a) (b) (c)



(d) (e) (f)

Fig.3 A example of IC-MIS

At beginning, the status of all nodes is white. From base station node v1, the status of v1 as the first dominating node is set to black, such as (a), and v1 carries out message broadcast. The status of the node receiving broadcast message is set to gray. v2, v3 and v4 become gray, such as (b). Then, all gray nodes continue to broadcast message outside. The white node receiving message sets the status of v5, v6, v7 v8 and v9 to blue, such as (c). The blue node broadcasts message outside. The nodes receiving the message reply message quickly. The blue node receives priority Pro of message calculation nodes, informs Pro of the highest node v11 as the dominating node to be determined, sets the status to be red and broadcast message outside, such as (d). The white node which has received calculates its replacement nodes through broadcasting message outside, i.e. IS with the largest WIS (WIS=the number of nodes covered / the number of dominating nodes) value. At this moment, v10 and v12 are chosen as the next real dominating node, such as (e). Hereto, two-hop nodes with the base station being the standard have been fully covered. v1, v10 and v12 serve the final MIS. The dominating nodes v10 and v12 which are just chosen carry out the next round of broadcast. Coverage efficiency improves greatly through selecting the next dominating node within three-hop. Meanwhile, replacement of the dominating node to be determined with IS avoids local optimum so that the final result is further optimized. Detailed steps of the algorithm are introduced as below.

IC- MIS algorithm

Input: Graph G=(V,E), initialize D set to be null and set the status of all nodes to white.

From base station node B, node B as the first dominating node is added in D set, updates its status to black and broadcasts message m1 to neighbor nodes within one-hop range.

After each adjacent node receives m1, it sets its status to gray and broadcasts message m2 to neighbor nodes within one-hop range. After each white node receives message m2, it sets its status to blue.

Each blue node continues to broadcast message m3 to nearby one-hop. After node t receives message m3, respective priority Pro(v) is calculated as per Definition 8. All blue nodes elect a white node Dt with the highest priority through comparison as a dominating node to be determined and set the status to red. If the priority is equal, the node with larger degree will be chosen; if node degree is equal, the node with small node ID is given the priority. If there is no node Dt under white status, the node with the highest Pro(v) from blue nodes is chosen as Dt.

When node Dt is selected, IS of node Dt within one-hop range is calculated through broadcasting message. At this time, many ISs will appear. We chose IS with the largest WIS (WIS=the number of nodes covered / the number of dominating nodes) to replace Dt and restore the status of node Dt to white. At this moment, the node in IS serves as selected dominating node. The status of node in IS is set to black, and the node within one-hop range is updated to gray.

Repeat the above operations until no white node exists in all nodes.

4 Simulation experiments

In the simulation experiment, we compare IC-MIS, IK-ST and ML-ST algorithms with Rajiv Misra's algorithm (collaborative coverage algorithm). The algorithm is evaluated in accordance with the number of nodes in CDS. In this paper, Ad Hoc network model is simulated in such way: randomly deploy sensor nodes in a 100*100 rectangular region and make sure the whole network is a connected graph. We assume communication radius of each sensor node is a fixed value r. If the distance between sensor node u and sensor node v is less than r, it is believed an edge exists between u and v. Therefore, the whole network is abstracted as a unit disk graph. The simulation experiment mainly compares two aspects; (1) compare the number of MIS in the first stage of CDS construction; (2) compare the number of Steiner nodes in the second stage of CDS construction. In the experiment, communication radius of sensor nodes is set to 25, 30, 35 and 40, respectively. The number of network nodes is set to 25, 50, 100 and150,

respectively. Then, the algorithm is operated for 1000 times, and the average value is taken. The detailed situation of the experiments is as follows:

In the first experiment, we compared IC-MIS algorithm and Rajiv Misra's algorithm. This experiment mainly evaluates the algorithms through comparing the number of nodes in MIS solved during working out CDS. The results of simulation experiment are shown in Fig.4, Fig.5, Fig.6 and Fig.7. IC-MIS algorithm reduces overlapped coverage as far as possible, so the number of MIS decreases relatively, and coverage efficiency improves. The effect of IC-MIS algorithm is significantly superior to Rajiv Misra's algorithm. IC-MIS algorithm can acquire smaller-scale CDS.

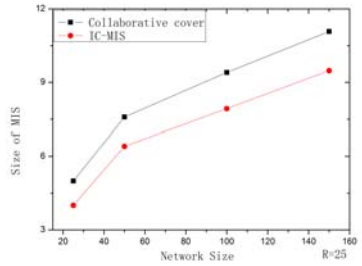


Fig.4(R=25)

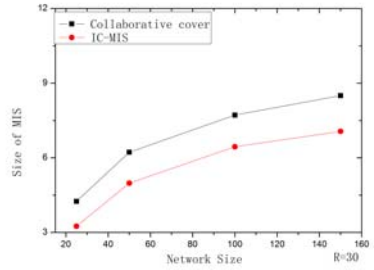


Fig.5(R=30)

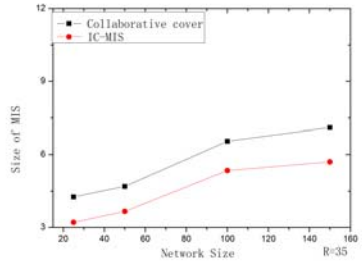


Fig.6(R=35)

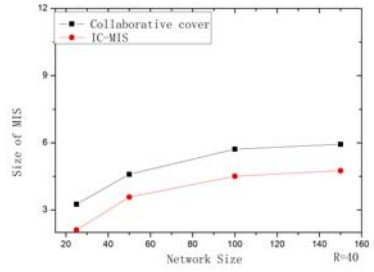


Fig.7(R=40)

5. SUMMARY

This paper proposes corresponding improved algorithms according to the objective of constructing MCDS. In the stage of solving MIS of CDS, an improved MIS algorithm based on collaborative coverage - IC-MIS is put forward. In the stage of Steiner tree construction, two algorithms to construct Steiner tree - IK-ST and ML-ST are proposed. The experiments have proven that the algorithm proposed in this paper can gain smaller-scale CDS. The performance of virtual backbone network composed of the connected dominating set depends on many factors. The smaller scale is the one of the important aspects. In the future, we will consider the residual energy of nodes, node threshold and other factors in the research.

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Illumination Compensation for Color Face Image Based On Reference White and Wavelet Reconstruction

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Abstract: To resolve the problem of uneven illumination of face images in understanding and analysis, especially the color information of skin, etc.,which is more vulnerable to be influenced by light, this thesis firstly presents an detailed anlysis on the the effects of face images caused by illumination changes. Then the original image was processed by using reference white method;an illumination compensation method based on reference white and improved wavelet reconstruction is proposed after analyzing the effects of the white reference method. The image brightness is improved and the noise is eliminated,at the same time, the details of the image is reserved well by the method of improved wavelet multiscale decomposition and reconstruction algorithm. Illumination compensation experiments is made in the CMU PIE face database and the processed facial images are detected by using Adaboost algorithm.The results show that this illumination compensation method is better and faster than several other traditional methods .
Keywords: reference white; wavelet reconstruction; face images; illumination compensation

1. INTRODUCTION

In recent years, there's new development on face recognition study while various theories and methods about face recognition have been proposed. The existing methods are sensitive to changes in the conditions of illumination, age, facial expressions, posture, and distance, etc. The recogonition effect is far from ideal while certain conditions change.

With higher and further application of image processing technology, the pretreatment of color image becomes more and more important, and it contains more information than the gray image.

The superiority of color image is much better than the gray image in some aspects whether from human visual perception or from deeper analysis and understanding.

Color images for face detection and recognition becomes a hot topic due to the further development of digital technology. However, uneven illumination changes the original features of the image to some extent and increases the difficulty of further processing[1].

In FRVT2002 test report[2]: When the angle of the light changes less than 15°, the error rate of face recognition will be less than 5%; When the change is more than 45°, the error rate will be about 48%; When the change is more than 60°, the error rate will be around 76%.

According to the view above, illumination change has great effects on face detection, especially skin color is more vulnerable to be influenced by illumination changes. Therefore, light treatment should be applied to the image before face recognition.

In order to solve the problem of uneven illumination and low brightness over the image, pre-processing of image, esp. the color image enhancement becomes an important step in the actual face detection and recognition.

The specific performance of Image uneven illumination are in the following aspects[3,4] Such as low overall grayscale (common in the infrared images and night images), low local gray value, Low local gray value caused by uneven illumination, low contrast ratio, illegible local information, high light phenomenon or part of the image in high light district,etc. For the human face image, it is mostly embodied in uneven illumination and high light phenomenon.

There are mainly three types of image enhancement methods depending on the specific application purposes[5,6]. They are space domain enhancement method, transform domain enhancement method and the method based on parameter optimization.

Among them, transform domain enhancement method is to transform the image into the wavelet domain or frequency domain, correcting the transform coefficients of the image, and then obtain an enhanced image through the inverse transform. Eg. homomorphic filtering method based on light reflection model.

2. THEORY AND ANALYSIS OF ALGORITHMS

A. Reference white

The brightness information of image is constituted by the incident and reflection components[7]. When the light is relatively dull, the prominent part of the face has a high reflectivity with high optical phenomenon, while the recessed portion,such as the human eye, will be dim with fuzzy details in low level of illumination.

According to the theoretical analysis above, the reference white is suitable for low light and uneven illumination image enhancement. On the one hand, it

enhances the brightness of the image.On the other hand, it improves the color information of the image to make it more natural and more confortable for the observation of human eyes.

Jain A.K. has proposed a reference white illumination compensation algorithm[8,9]. The principle of this algorithm is that assuming there is a white area in the image,the color is balanced according to the white area.

Convert the color image from RGB color space to YCbCr color space, then select the luminance component Y, ascending the brightness of all the pixels in the entire image and select the mean value of the bright portion pixel (herein take 3%) as reference white. The lowest pixel value which satisfies the conditions is token as threshold, denoting T_1.

Conversely, descend the brightness of all the pixels in the entire image and select the mean value of the bright portion pixel (herein take 3%) as reference black, The highest value which satisfies the conditions is token as threshold, denoting T_2.

The pixel value with gray level i is denoted by $y(i)$, assuming the total quantity of pixels is n_1 when $y(i) \geq T_1$, and the total quantity of pixels is n_2 when $y(i) \leq T_2$, the total pixels of picture is m. The mean value R_{mean1}, G_{mean1}, B_{mean1} for R,G,B component in the condition of reference white respectively are:

$$R_{mean1} = \frac{\sum_{i=1}^{m} R(i)}{n_1}, \quad y(i) \geq T_1 \qquad (1)$$

$$G_{mean1} = \frac{\sum_{i=1}^{m} G(i)}{n_1}, \quad y(i) \geq T_1 \qquad (2)$$

$$B_{mean1} = \frac{\sum_{i=1}^{m} B(i)}{n_1}, \quad y(i) \geq T_1 \qquad (3)$$

The mean value R_{mean2}, G_{mean2}, B_{mean2} for R,G,B component in the condition of reference black respectively are:

$$R_{mean2} = \frac{\sum_{i=1}^{m} R(i)}{n_2}, y(i) \leq T_2 \qquad (4)$$

$$G_{mean2} = \frac{\sum_{i=1}^{m} G(i)}{n_2}, y(i) \leq T_2 \qquad (5)$$

$$B_{mean2} = \frac{\sum_{i=1}^{m} B(i)}{n_2}, y(i) \leq T_2 \qquad (6)$$

The normalized value R_{norm}, G_{norm}, B_{norm} of R,G,B component according to reference black and reference white respectively are:

$$R_{norm} = \frac{R - R_{mean2}}{R_{mean2} - R_{mean1}} \bullet \gamma_R \qquad (7)$$

$$G_{norm} = \frac{G - G_{mean2}}{G_{mean2} - G_{mean1}} \bullet \gamma_G \qquad (8)$$

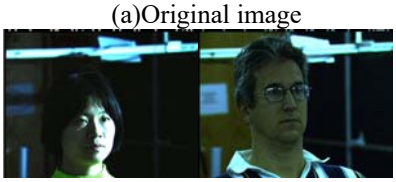
$$B_{norm} = \frac{B - B_{mean2}}{B_{mean2} - B_{mean1}} \bullet \gamma_B \qquad (9)$$

In the formulas above, γ_R, γ_G, γ_B is adjustment factor for adjusting in different circumstances.We select 3 groups of different coefficients to process images with reference white.

In Fig.1,pictures in Fig.1(a) are the Original image, Pictures in Fig.1(b) are in the condition of γ_R=40, γ_G=65, γ_B=65, pictures in Fig.1(C) are in the condition of γ_R=60, γ_G=75, γ_B=75. According to the processing result, the chromaticity of the images are more natural and the brightness is better improved when $\gamma_R : \gamma_G : \gamma_B = 4:5:5$. However, there is server over enhancement phenomenon as the coefficient increasing, the coefficients we use in this paper are 60,75,75 respectively.

The overall brightness of the image processed by reference white is improved and the color of the image appears more natural, more in line with the human visual system; However, there are some differences from the previous theoretical analysis serious for uneven illumination, especially under cool light and images in night. there is Local high light phenomenon and the images lost some important detail components, resulting in reduced face detection and recognition accuracy.

(a)Original image



(b) γ_R=40, γ_G=65, γ_B=65

(c) γ_R=60, γ_G=75, γ_B=75

Figure 1 The results of different adjustment factors

B. Multistage decomposition and reconstruction algorithm of Haar wavelet

Wavelet basis selection should satisfy translational invariance for image enhancement; Redundant wavelet transform is commonly used in wavelet transform image enhancement; Some orthogonality Portadown decomposition data is recommended for processing image details in the field of numerical

calculation[10]. Haar wavelet basis, the first orthonormal wavelet basis, is given by French mathematician A.Haar.

A group of functions that can be used for decomposing and reconstructing signals constitutes orthonormal basis of the function space $L^2(R)$, which generated by the Haar wavelet scaling function $\psi(x)$ and wavelet function $\varphi(x)$. Continuous signal whose energy is limited belongs to $L^2(R)$ is sampled, and then decomposing the signal sampling into the coupling portion and the odd portion, namely:

$$f_j(x) = \sum_{i\in Z} a_{2i}^j \psi(2^j x - 2i) + \sum_{i\in Z} a_{2i+1}^j \psi(2^j x - 2i - 1) \quad (10)$$

Further calculation is

$$f_j(x) = \sum_{i\in Z} (\frac{a_{2i}^j - a_{2i+1}^j}{2}) \varphi(2^{j-1} - x - i) + \sum_{i\in Z} (\frac{a_{2i}^j - a_{2i+1}^j}{2}) \psi(2^{j-1} - x - i) = W_{j-1}(x) + f_{j-1}(x) \quad (11)$$

Set $w_{j-1}(x) \in W_{j-1}$, $j_{j-1}(x) \in V_{j-1}$, then:

$$w_{j-1}(x) = \sum_{i\in Z} (\frac{a_{2i}^j - a_{2i+1}^j}{2}) \varphi(2^{j-1} - x - i) \quad (12)$$

$$f_{j-1}(x) = \sum_{i\in Z} (\frac{a_{2i}^j - a_{2i+1}^j}{2}) \psi(2^{j-1} - x - i) \quad (13)$$

Decomposing from $f_j(x) = W_{j-1}(x) + f_{j-1}(x)$ steeply , we can draw

$$f_j = w_{j-1} + w_{j-2} + \cdots + w_1 + w_0 + f_0 \quad 14)$$

Decompose $f_j(x)$ into different frequency components. Under the resolution 2^{j-1}, $f_{j-1}(x)$ is the low-frequency signal component and the smooth approximation of the signal, which denotes the main information of signal; $w_{j-1}(x)$ is the high-frequency signal component ,which denotes the detailed information of signal.

Wavelet reconstruction algorithm is the opposite decomposition algorithm, Calculating $f_1 = w_0 + f_0$ firstly, and then calculating f_j based on mathematical induction.

Letting $w_j^{'}(x)$ denotes high frequency components of wavelet decomposition after histogram equalization image in j scale space and $f_j^{'}(x)$ denotes low frequency components of wavelet decomposition after histogram equalization image in j scale space; $w_j^{''}(x)$ denotes the high frequency components of wavelet decomposition after the image processed by reference white in j scale space and $f_j^{''}(x)$ denotes low frequency components of wavelet decomposition after the image processed by reference white in j scale space.Thus,the low frequency components in j+1 scale space is

$$f_{j+1}(x)\_LL = 0.3 f_j^{'}(x)\_LL + 0.7 f_l^{''}(x)\_LL + \max(w_j^{'}(x)\_LH, w_j^{''}(x)\_LH) + \max(w_j^{'}(x)\_HL, w_j^{''}(x)\_HL) \quad (15)$$

According to symmetry of wavelet function, aberration and distortion of the reconstructed image in the reconstruction process can be avoided and eliminated to achieve the accuracy requirements of reconstruction after processed by wavelet coefficients.

Currently, the study on wavelet transformation in image processing applications are numerous, but lacking of color image study and enhanced low-frequency components of image. Therefore, the effect of traditional approach is not ideal for low-contrast image.

C. The idea of the proposed algorithm

According to the limitations of reference white approach and the advantages of two-dimensional multi-scale wavelet decomposition and reconstruction , This thesis proposed an improved method of illumination enhancement for color images based on reference white and two-dimensional multi-scale wavelet reconstruction.

Firstly, acquire image luminance component V from reference white and adaptive histogram equalization through HSV transform . Then, decompose luminance component with 2 level Multi-scale wavelet and select the max value of High-frequency coefficients with noise.

Remove the noise of image based on the differences between signal and noise in different scales modulus values figure and the principle of modulus maxima[11,12]. Meanwhile, Combine the low frequency coefficients of the image Linearly. The modified wavelet coefficients and scale coefficients are the parameters of wavelet reconstruction.

In this way, not only the details of the image are enhanced but also the influence of light over-enhancement is suppressed.

3. EXPERIMENTAL RESULTS AND ANALYSIS

To verify the performance of the proposed method , select 10 individuals (10 subsets) among a total of 500 face pictures in the illum group in CMU PIE face database under varying degrees of light. Conduct experiment and a series of contrast respectively by using Histogram equalization, Adaptive histogram equalization, reference white, Single retinex and the proposed method in this thesis.

Fig.2 are the treatment results of three people(one image per person), Fig.2(a) is the original image. Fig.2(b) is the processed results of histogram equalization which is simple, efficient and better image processing effect for overall brightness uniformity dim. Moreover, it can effectively improve the brightness and overall contrast of the image. However, it isn't suitable to be applied to enhance high brightness or high-light phenomenon image. Otherwise, serious mosaic phenomenon will emergence .

The Fig.2(c) is the result of adaptive histogram equalization, which enhances the overall brightness

and contrast of the image to a certain extent. However, the color of the image is unnatural with overall dim effect. The Fig.2(d) is the result of the reference white and it appears too high local optical phenomena.

Fig.2(e) is the processed results of single-scale Retinex transform. Assuming illumination changes are uniform in illumination estimation[13,14]which does not comply with the actual situation, so images with strong or weak phenomenon appears in the sharp contrast light and shade as well as image edge burr which will influence the effect of image edge detection. Fig.2(f) is the processed results of the proposed method in this thesis, it not only reserves the details of face, but also improves the brightness of the whole face image.

(a) Original image

(b) Histogram equalization

(c) Adaptive histogram equalization

(d) reference white

(e) Single retinex

(f) The proposed method

Figure2. The results of different illumination compensation methods

Using the image contrast (C) in the contrast sensitivity and the peak signal-to-noise ratio (PSNR) described in literature [15,16] to evaluate the images processed, the obtained data are showing in Tab.1.Image contrast in contrast sensitivity makes correct evaluation of the losing of image details for underexposure; the value of represents Image distortion and image quality to some extent.

Adaboost algorithm[17]can be used for face detection,which is according to the accuracy of classification in training of current and the first overall classification, after many trainings, a strong classifier is formed through fusioning up the classifiers of each training at last. Adaboost algorithm has higher face detection accuracy, and it makes human face detection speed improved, compared with other face detection algorithms, eg. Hidden Markov and neural network.

Tab.1 lists the four subsets of the processed result data.Among them, contrast sensitivity image contrast (C) and the peak signal-to-noise ratio (PSNR) are the average value of each group data and T is the face detection rate expressed as a percentage.

Table1. Contrast,PSNR and face detection(T%) of some methods

Name	Measure parameters	Histogram equalization	Adaptive histogram equalization	reference white	Single retinex	The proposed method
Subset one	C	0.1963	0.2676	0.2816	0.1910	0.4322
	PSNR(dB)	8.9351	21.8512	13.1153	6.6755	17.2531
	T	88	88	96	78	100
Subset two	C	0.3520	0.3527	0.3915	0.0892	0.4783
	PSNR(dB)	8.7891	21.1669	15.8081	6.4571	17.8628
	T	88	88	96	76	100
Subset three	C	0.1956	0.3263	0.4078	0.1071	0.4538
	PSNR(dB)	8.3935	22.3217	13.1964	6.2146	18.7208
	T	88	88	94	76	98
Subset four	C	0.1935	0.3970	0.4276	0.0732	0.4810
	PSNR(dB)	8.5085	20.0848	14.8913	6.3971	18.8910
	T	88	88	96	76	100

Compared with several other image enhancement methods, the main features of the proposed method are in the following aspects.

1)The coefficients of the wavelet decomposition are processed pertinently and the computation is reduced compared with the common binary convolution wavelet.

2)During noise filtering enhancement, wavelet reconstruction, a large number of noise is introduced by reference white method while adaptive histogram equalization has higher signal-to-noise ratio and contrast but low luminace enhancement effect. Therefore, to get better processing effect, we can use wavelet reconstruction through combining the wavelet coefficients of the two types of pictures, without increasing extra computation amount while superior than the direct wavelt domain data enhancement method.

3) High light phenomenon of images is eliminated by the proposed method and the color information is more clear, natural, suitable for observation of the human eye, as well as subsequent image understanding and analysis. Combining the luminance enhancement and the denosing method organically, it provides a new idea on how to solve the problem of image denoising enhancement, as well as recovery after illumination compensation.

4 conclusion

To solve the problem that traditional illumination processing algorithm is not ideal when dealing with complex lighting effects, this paper presents an effective and rapid enhancement algorithm for color face image based on the reference white and wavelet reconstruction. In this paper, using images in MCU PIE face database, the light enhancement method is compared with several traditional lighting enhancement methods.

It shows from the result of the experiment that the brightness and detailed information are enhanced and the face detection rate has been effectively improved through proposed image enhancement method.

Although this method improves the entire brightness of the image, but for the shielding part (eg. the dark areas for shadow), the effect should be further improve.

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Improved Steiner Tree Construction Algorithm

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Abstract: In Ad Hoc sensor network, seeking a MCDS (Minimum Connected Dominating Set) as virtual backbone network of the network in order to reach effective communication of network becomes a hot issue of researchers. MCDS problem is a typical NP-complete problem. Researchers propose a variety of approximation algorithms to construct MCDS. Two-stage through is adopted to construct MCDS, which reaches the best effect. Firstly, a MIS (maximum independent set) is set up, then Steiner tree construction algorithm is applied to add Steiner nodes so as to achieve connection. First of all, this paper proposes an IC-MIS algorithm based on improved collaborative coverage to solve MIS. The selection of dominating points expands to 2-hop neighborhood to 3-hop. Under the condition where full coverage is ensured, overlapping coverage among dominating points decreases and coverage efficiency improves. Then, two types of Steiner tree construction algorithms: improved Kruskal-Steiner tree construction algorithm (IK-ST) and maximum leaf node Steiner tree construction algorithm (ML-ST). IK-ST constructs MIS node to a generating tree through Kruskal algorithm, and then Steiner tree construction is achieved through adding nodes to replace the side. ML-ST algorithm adopts the thought of maximum leaf node tree. Firstly, calculate the weights for every edge according to certain strategy then a steiner tree is generated with merging edges. The experiment has proven that the algorithm proposed in this paper is able to work out smaller-scale CDS.

Keywords: Ad Hoc sensor network, maximum independent set (MIS), minimum connected dominating set (MCDS), Steiner tree, minimum spanning tree

1. INTRODUCTION

An effective virtual backbone network should satisfy two features; 1) backbone network can cover the whole network; 2) backbone networks are mutually connected and convey news through transmission. In convey news, CDS is defined as a spanning subgraph of an undirected graph G. This subgraph meets two conditions: 1) for any point v in the subgraph, v is adjacent to at least one point in this subset; 2) the subgraph is a connected graph. Thus, construction of such virtual backbone network may be abstracted to the problem of CDS construction in graph theory [8,9,10]. In satisfying the requirements of cases, the scale of the connected dominating set should be as smaller as possible so that more nodes can save energy by periodic dormancy. At the same time it can also reduce the size of the routing table, reduce the cost of computation and maintain the cost of routing tables. Seeking a CDS which meets such conditions and owns minimum number of nodes is called MCDS problem[11]. This problem is a typical NP-complete problem[12]. Hence, researchers solve approximate solutions of this problem through different algorithms. The size of CDS (i.e. the number of nodes) serves as a standard to measure an algorithm. The smaller the size of CDS will be, the easier the control of the network will be. It effectively reduces the unnecessary routing forwarding so as to save energy. In recent research, the algorithm of building a steiner tree [13,14] to optimize the CDS is best, namely building a MIS in the first phase and adding Steiner node to make the MIS connected in the second phase so as to get a CDS. In allusion to the number of nodes, the improvement is conducted in the two stages where CDS is constructed. An algorithm based on improved collaborative coverage which is used to work out MIS - IC-MIS and two types of Steiner tree construction algorithms - IK-ST and ML-ST are proposed.

This paper is organized as follows: in the second part, this paper discusses related work of CDS construction; in the third part, network models and some symbol definitions are introduced; in the fourth,the thought and steps of IC-MIS algorithm are described in detail; in the fifth part, IK-ST algorithm and ML-ST algorithm are presented in detail; in the sixth part, we offer relevant experiments to prove the good effect of the algorithm proposed in this paper. Finally, a summary is conducted for the whole paper.

2. ML-ST ALGORITHM

We suppose there is spanning tree T In a given Graph G. The sum of degree of spanning tree T is equal to the number of leaf nodes plus the number of non-leaf nodes which multiplies by the degree of non-leaf nodes. If the number of leaf nodes should be as many as possible, the number of non-leaf nodes will decrease. Meanwhile, the degree of non-leaf nodes is 2required to be as large as possible. Based on such thought and CDS problem to be solved in this paper, if the whole network is regarded as an undirected graph, virtual backbone network which is formed by CDS amounts to a spanning tree of Graph G; the dominating node amounts to a non-leaf node in the tree; the node dominated amounts to a leaf node in the tree. Hence, CDS problem can be transformed to

the problem of solving a spanning tree with the most leaf nodes. The detailed process of ML-ST is as follows:

Input: Graph G=(V,E), dominating set D=MIS; initialize a set Er to be null; the status of nodes in D is black; the remaining nodes are black.

Initialize an edge set Et; all existing edges in the graph are added in Et through node broadcasting.

The weight Wt of each node is calculated through broadcasting message; the basis of calculation is subject to Definition 5. In this way, edges of nodes in adjacent MIS can be preferentially selected in the spanning tree.

Traverse each edge of Et and set the weight for each edge as the basis for merging and solving spanning tree. We calculate edge weight as per definition 7 and choose an edge e. We2=Ws+Wd, where Ws and Wd are weights gained in Step (2). Meanwhile, Ws represents the weight of source node of e; Wd represents the weight of destination node of e.

Start from any node of MIS and traverse edges in Et; choose the edge with largest We2 to add into Er; if We2 is equal, any edge may be chosen. The number of current nodes is updated until the number of nodes is equal to the number of network nodes.

Trimming strategy is carried out for the spanning tree which is formed by edges in Et. Trimming strategy is as follows: traverse each node; if the degree of a node is 1 and this node is not a black node, this node and its relevant edge are deleted together.

Optimize the spanning tree treated in (5) and traverse nodes in the spanning tree successively. If all black nodes adjacent to node t' can be adjoined by the remaining nodes, and can form a spanning tree, t' is deleted. The final edge set Er forms a Steiner tree. The number of all nodes in the tree is expressed as DST.

Output: DS

3. SIMULATION EXPERIMENTS

In the simulation experiment, we compare IC-MIS, IK-ST and ML-ST algorithms with Rajiv Misra's algorithm (collaborative coverage algorithm). The algorithm is evaluated in accordance with the number of nodes in CDS. In this paper, Ad Hoc network model is simulated in such way: randomly deploy sensor nodes in a 100*100 rectangular region and make sure the whole network is a connected graph. We assume communication radius of each sensor node is a fixed value r. If the distance between sensor node u and sensor node v is less than r, it is believed an edge exists between u and v. Therefore, the whole network is abstracted as a unit disk graph. The simulation experiment mainly compares two aspects; (1) compare the number of MIS in the first stage of CDS construction; (2) compare the number of Steiner nodes in the second stage of CDS construction. In the experiment, communication radius of sensor nodes is set to 25, 30, 35 and 40, respectively. The number of network nodes is set to 25, 50, 100 and150, respectively. Then, the algorithm is operated for 1000 times, and the average value is taken. The detailed situation of the experiments is as follows:

In the first experiment, we compared IC-MIS algorithm and Rajiv Misra's algorithm. This experiment mainly evaluates the algorithms through comparing the number of nodes in MIS solved during working out CDS. The results of simulation experiment are shown in Fig.4, Fig.5, Fig.6 and Fig.7. IC-MIS algorithm reduces overlapped coverage as far as possible, so the number of MIS decreases relatively, and coverage efficiency improves. The effect of IC-MIS algorithm is significantly superior to Rajiv Misra's algorithm. IC-MIS algorithm can acquire smaller-scale CDS.

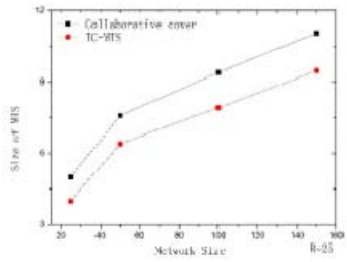


Fig.4(R=25)

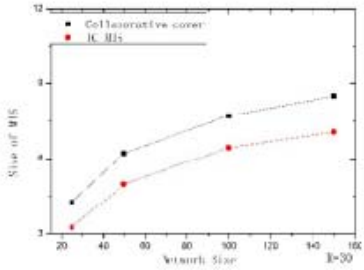
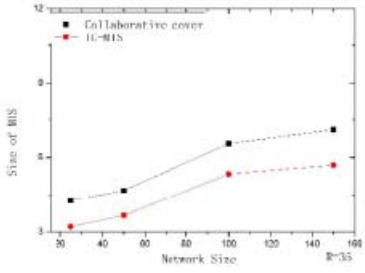


Fig.5(R=30)



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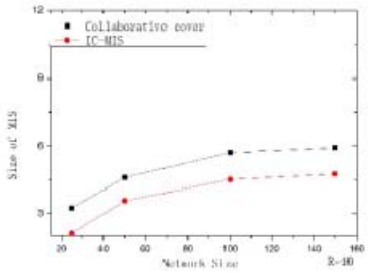

Fig.7(R=40)

In the second experiment, we optimized Steiner tree construction stage of Rajiv Misra's algorithm through IK-ST and ML-ST algorithms and then compared them. Through comparison, we gained the number of Steiner nodes to evaluate the algorithms. In the experiment, the algorithm is assessed through the size of CDS (CDS=MIS+ Steiner nodes, where MIS is same). The results of simulation experiment are shown in Fig.8, Fig.9, Fig.10 and Fig.11. It can be seen from the figures that when the number of network nodes is small, the number of connected nodes gained by the three algorithms differs little. However, as the number of nodes rises, the effects of IK-ST algorithm and ML-ST algorithm are obviously superior to Rajiv Misra's algorithm. This indicates IK-ST and ML-ST can avoid being caught in locally optimal solution and achieve optimization of the number of nodes. IK-ST owns the best effect and can acquire CDS with smaller number of nodes.

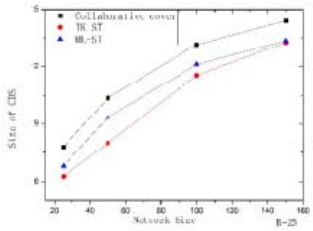

Fig.8(R=25)

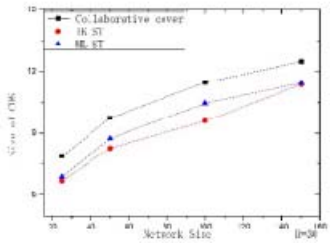

Fig.9(R=30)

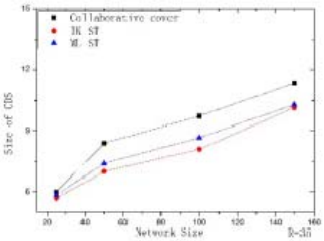

Fig.10(R=35)

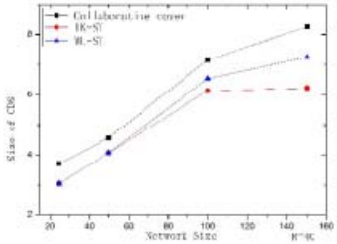

Fig.11 (R=40)

In the third experiment, we combined IC-MIS algorithm with IK-ST and ML-ST, respectively and used IC-MIS algorithm to solve MIS in the first stage. Then, we compared it with Rajiv Misra's algorithm. The algorithms are evaluated according to the number of nodes in CDS. The results of simulation experiment are shown in Fig.12, Fig.13, Fig.14 and Fig.15. It can be seen from the figures that good effects are gained through combining IC-MIS algorithm with IK-ST and ML-ST. Besides, as communication radius rises, the differences in the effects become increasingly obvious. Meanwhile, when the communication radius is certain, as the number of nodes rises, the effect of IC-MIS algorithm is obviously superior to Rajiv Misra's algorithm. When IC-MIS algorithm is combined with IK-ST, the effect is the best.

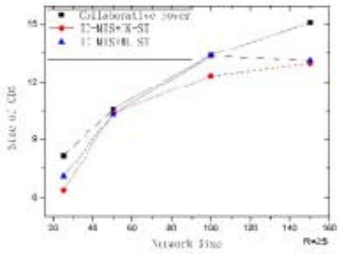

Fig.12(R=25)

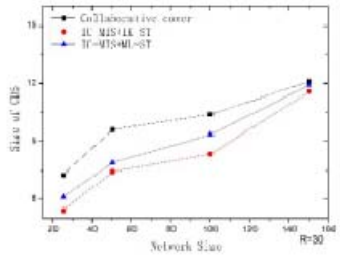

Fig.13(R=30)

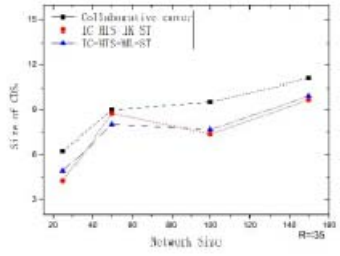

Fig.14(R=35)

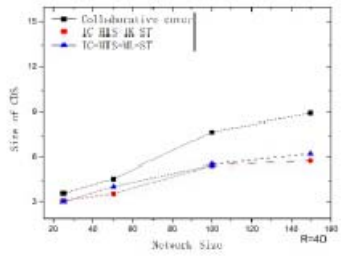

Fig.15(R=40)

4. SUMMARY

This paper proposes corresponding improved algorithms according to the objective of constructing MCDS. In the stage of solving MIS of CDS, an improved MIS algorithm based on collaborative coverage - IC-MIS is put forward. In the stage of Steiner tree construction, two algorithms to construct Steiner tree - IK-ST and ML-ST are proposed. The experiments have proven that the algorithm proposed in this paper can gain smaller-scale CDS. The performance of virtual backbone network composed of the connected dominating set depends on many factors. The smaller scale is the one of the important aspects. In the future, we will consider the residual energy of nodes, node threshold and other factors in the research.

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Multi Scale Analysis of a Rainstorm Process in Dandong Area

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Abstract: By Typhoon "Fenghuang" weak tropical low pressure on the southeast side of low water vapor and Mongolia cold front crossing the influence, 2008 July 31 to August 1, Dandong region appears a rainstorm weather process, individual towns reached magnitude of heavy rain. By using conventional meteorological data, satellite cloud image data and ground encryption automatic weather station, the multi-scale analysis of the precipitation process was carried out. Results show that: (1) subtropical high-pressure rear southwest airflow guiding role and surface cold front and the front part of the weak cold air diffusion and low level jet transport of water vapor is the effect of the strong precipitation process of large scale circulation background; (2) the heavy rain process exist obvious mesoscale dew point front and ground cyclone; (3) satellite organized mesoscale convective system (MCS) of heavy rainfall near the early warning and forecasting have important implications.
Keywords: heavy rainstorm; multi-scale; dew point front; mesocyclone

1. INTRODUCTION

Dandong is a storm center in the north of China, the number of rainstorm occurred every year in flood season, rainfall is large. Over the years, the research and summary of Dandong heavy rain has been constantly carried out. With the development of science and technology, all kinds of meteorological data are becoming more and more abundant, the scale is getting smaller and smaller, and the accuracy is higher and higher. On the basis of routine meteorological data, combined with satellite images, automatic weather station data encryption on 2008 July 31 - August 1, the whole area rainstorm process of multi-scale analysis, in order to reveal in the strong precipitation process and the characteristics of weather systems of different scales and interaction.

In July 2008, 31, 20 - August 1, 20, As shown in Fig.1, Dandong has affected typhoon "phoenix" weak tropical low pressure on the southeast side of low water vapor and Mongolia cold front crossing the influence, whole area following heavy rain, the individual towns to heavy rain. Heavy rain mainly concentrated in the eastern part of Fengcheng City, Donggang city and Kuandian County throughout, heavy rain concentrated in the vicinity of the north shore of the Yalu River. From the point of view of time distribution (Fig.2), short-time strong rainfall on August 1 from 6 o'clock to 10 and 15 o'clock to 19 o'clock, maximum one hour rainfall occurred in Kuandian County Da Chuan tou Zhen, achieve 39.5mm/h.

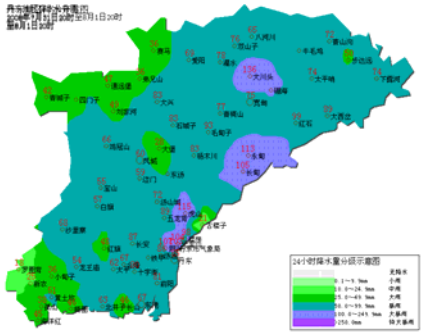

Figure 1 Dandong July 31, 2008 20 - August 1st 20 when rainfall

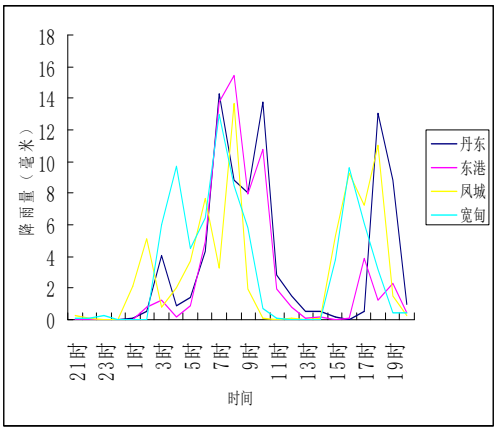

Figure 2 Hourly rainfall distribution of four basic stations in Dandong area

2. THE IMPACT OF LARGE-SCALE SYSTEMS ANALYSIS

Large-scale systems, while not directly produce heavy rain, but it provides a conducive rainstorm circulation background, by restricting the direct impact of storm-scale weather systems indirectly have an effect on the storm.

A. Early circulation

July 31,2008 08, 500hpa height field Eurasia high latitudes were two troughs and one ridge, two troughs located east of the Ural Mountains and Lake Baikal, located on the ridge extending to the west of Lake Baikal Lake Balkhash . Cold air accumulation in the Eastern Region, and northwest flow along the ridge before falling to Laguna de Bay added a large tank, so that the upper trough moving eastward in the

process of deepening development. North subtropical been jumping near 38 ° N, 20 o'clock in the day, the subtropical high westward extension obviously, west ridge point near 116 ° E, tropical depression east Typhoon "Phoenix" weakened after the water vapor to the south along the western subtropical high southerly airstream continues north.

B. Deputy high position and role

From 08 at the beginning of July 30 (not shown), the westward extension of the subtropical high northward obviously, to at 20:00 on July 31, subtropical high ridge line located in the vicinity of 37 ° N, then further westward extension of the subtropical high, the next day 08 Vice-west end of the ridge to arrive in central Hunan province. Deputy high along the rear of the strong southwest flow, the lower 700hpa and 850hpa from 30 July 0800 has remained a center of wind more than 20m / s rapids area, provided the impetus to support low-level low system north. Low system low latitudes constantly moving southwest to northeast in the direction of the air flow, to at 20 o'clock on July 31, the cyclone is located in Hebei and Shandong provinces at the junction, and continue to move the Liaodong Peninsula (Fig.3). August 1 0800 to less stable subtropical high position (not shown), such that the cyclone 850hpa although weakened into a shear line, but the moving speed slows down, and slowly moved to the northeast in the direction of the rear of the subtropical high, remained at Dandong a long time, which directly affect the heavy rain fall area.

C. LLJ and moisture conditions

Rainstorm appears mostly associated with low-level jet, the majority of the heavy rainfall in the low-level jet axis of the left front[1-4]. LLJ not only continue to transport moisture to the storm area, but also continue to transport heat and momentum, the formation of rain is very beneficial. The first period of heavy rain heavy precipitation process, mainly due to a tropical low pressure warm air along the southeast side of the subtropical high north western constantly caused. Here we can not but emphasize the role of water vapor and low-level jet. Analysis 850hpa wind farm visible from at 20:00 on July 30, in China's eastern coastal areas from Fujian to Jiangsu formed a southerly wind rapids, center of the largest wind reaches 25m / s, and continuous development of the north. To at 20:00 on July 31 this jet center is located in Shandong Peninsula, the maximum wind reached 24m / s, which has reached the northern end of Liaoning Province, and the formation of wind speed convergence (Fig. 4a) in Dandong. Rapids along a width direction of a longitude of t-td <3 wet area (Fig. 4b), from south to north so that a steady stream of water vapor transported to Dandong, directly contributed to the occurrence of heavy rain.

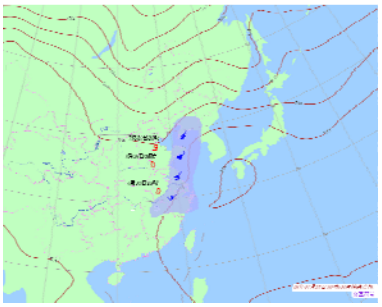

Figure 3 At 20 o'clock on the July 31 500hpa height field and 850hpa cyclone center position dynamic map (shaded area is the wind speed is greater than 12m / s rapids area)

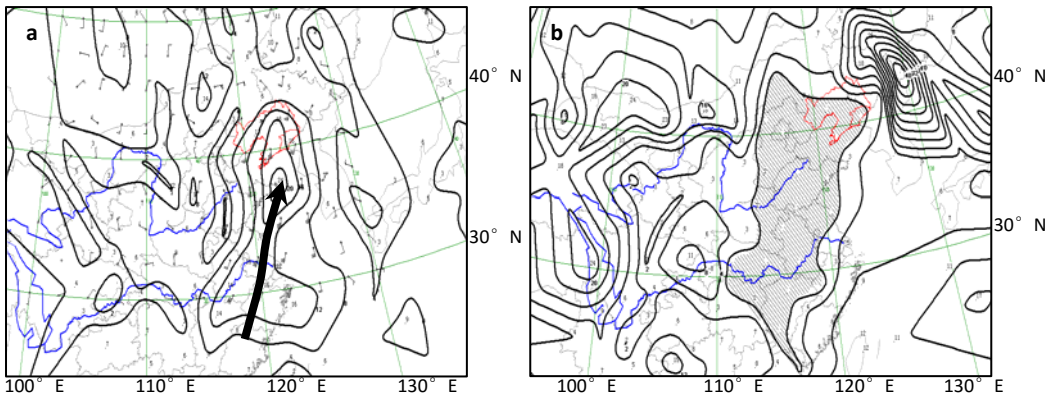

Figure 4 At 20 o'clock on the July 31, 2008 the temperature difference between the dew point and wind field analysis 850hpa different heights(Fig. 4a arrows jet direction; Fig. 4b is 700hpa dew point temperature difference analysis, shaded area wet area).

D. Diffusion surface cold front is weak cold front

Studies have shown that, in the role of heavy rains and cold air, the intensity should not be too cold, too cold air causes precipitation system weakened rapidly filling[5-6]. In a process of precipitation, maximum rainfall usually occurs in the warm air and cold air meet. Chart analysis from the ground, a tropical low pressure moving along the guide airflow to the northeast, and the eastward shift of the Mongolian cyclone combined to form a northeast - southwest direction with low pressure, resulting in two

north-south cold front eastward during the merger in western Liaoning. August 1 to 08 surface cold front (cold front A) is located in central Liaoning (Fig. 5), accompanied by a cold front eastward, the ground cold air southward. In addition, from Dandong encryption AWS data shows that in August 1st 01 when there is a weak deputy cold front generated and maintained in the west Kurau child to Chang'an line Dandong region 08 gradually weakened and vanished(Fig. 6), until the disappearance of its change of position not corresponding front before heavy rain center in Hushan, Wulongbei, Yuanbaoshan, Environment, rainfall exceeded 100 mm. It is this weak cold air is maintained so that the intersection of cold and warm currents in the Dandong area had heavy rainfall, the main reason for this is the first time a heavy rainfall rainstorm produced.

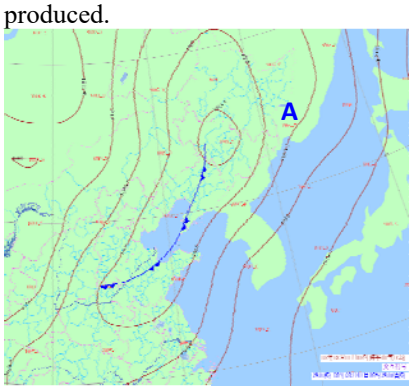

Figure 5 1 August 0800 the ground situation in the field

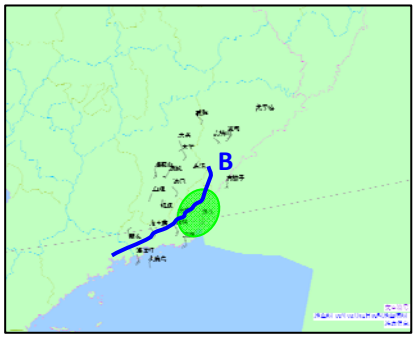

Figure 6 August 1 to 01 in Dandong encryption automatic stations wind farm(Shaded area is a strong precipitation area)

3. SCALE ON SYSTEM ANALYSIS

Mesoscale Atmospheric Motion is an important part of atmospheric circulation, a rainstorm is the product of a variety of atmospheric mesoscale systems interact[7]. Enabling large-scale circulation is to produce rain in the background, while the scale of the system is directly organize and produce heavy rainfall system.

A. Mesoscale dew point front (trunk)

The results of research show that, before a number of strong convective weather in the event of heavy rain, high altitude and there is no obvious shear line, vortex and other common mesoscale systems that affect the system in fact is a very strong trunk. Although the trunk itself will not bring strong weather, but there are closer to the upper trough 500hpa when often appear near convective weather. July 31 0800, there is a temperature difference between the dew point of less than 3 °C warm and humid area Liaodong Peninsula to the Shandong Peninsula, but no obvious trunk is formed. To 1 August 0800, with a clear dry tongue toward the Loop to the eastern part of Inner Mongolia, the biggest difference between the dew point temperature of 15 °C, this tongue dry and wet tongue located in the Liaodong Peninsula and Shandong Peninsula to constitute mesoscale trunk in western Liaoning. From 700hpa, 850hpa dew point temperature difference field.

Visible (Fig. 7), 1 August 0800, western Liaoning Province has obvious mesoscale dew point front (trunk) is formed, the dew point of the west front of the air is very dry, and its east is very humid air, dew point after the striker front poor contrast, which reflects in the lower diagram 925hpa more obvious, but in the layers above 700 hPa and no significant reaction, suggesting that strong airflow and warm wet and dry contrast mainly in the lower troposphere. On 500hpa weather chart (not shown) with the upper trough eastward to the eastern part of Liaoning Province, Feng dew point becomes active, prompting produce heavy rainfall in most parts of the city.

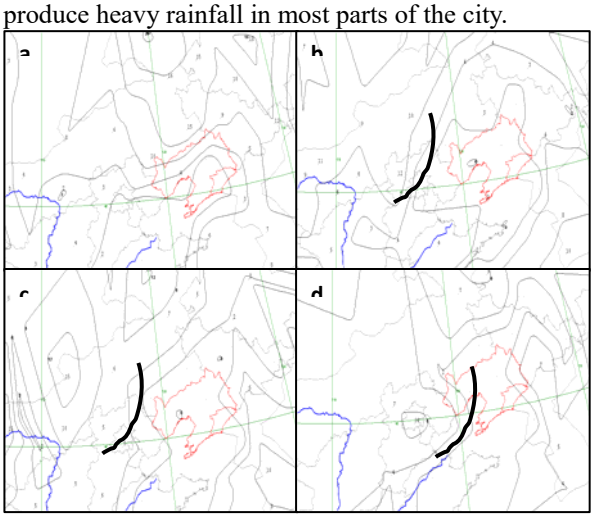

Figure 7 t-td general analysis and exposed forward position shown (a of 31 July 0800 850hpa, b is 1 August 0800 700hpa, c is 1 August 0800 850hpa, d is 1 August 0800 925hpa

B. Ground cyclone

At 14:00 on August 1st, the ground has been located on the map cold front in the eastern part of the city (not shown). Simultaneous analysis of wind data encryption automatic stations found that changes in wind direction counterclockwise rotation between 15:00 Kurau child in the city (Fig. 8), green chair Mountain, Fort, side door, forming a closed loop that is the ground mesoscale cyclone. The cyclone to less stable position, the duration is very short, at around 19:00 gradually weakened until it disappears. A combination of one hour of FY-2C satellite image analysis (Fig. 9), this period corresponds exactly to

the west of the development of growth Kurau sub-region Friday wulongbei convective clouds, indicating that the cyclone on the development of heavy rainfall convective clouds have promoted , it is an important cause of this heavy rain mesoscale system.

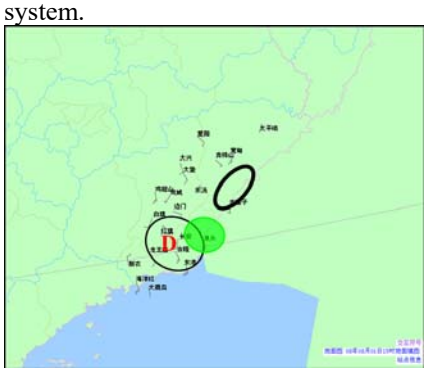

Figure 8 At 15:00 on August 1 in Dandong encryption automatic stations wind farm(Shaded area is a strong precipitation area)

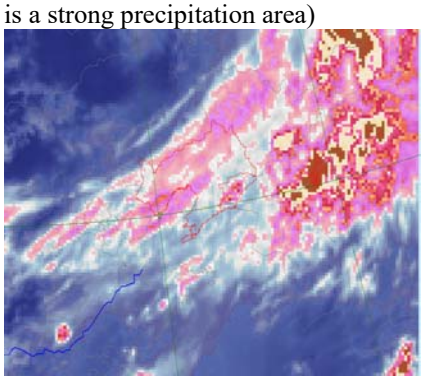

Figure 9 At 15:00 on August 1 FY2C infrared satellite imagery(Circle as indicative of the convective cloud development)

C. mesoscale convective system (MCS)

In the second period of heavy rainfall concentrated in the heavy rain, due to the cold front approaching Mongolia, a strong disturbance, so that the local atmosphere becomes unstable mesoscale convective systems will be formed in this case. Weather in MCS system, the largest, longest circulation system is called mesoscale convective complex (MCC) of. On satellite images, MCC mainly for large oval system, active convective zone is typically in the forefront of MCC, although sometimes the coldest Genting also appear near the center of the MCC, but colder Genting frontier area is often MCC detected. In order to better reveal the evolution of the heavy precipitation during the MCS, the use of FY-2C satellite cloud pictures and a half hours (Fig. 10) of the heavy rainfall process analysis.

Fig.10 shows that the impact of heavy rainfall MCS Dandong has a typical development, maturity, life cycle characteristics disappear. At 14:30 on August 1 (Fig. 10a), with A, B two mesoscales convective convergence assembly (MCC) to Dandong mobile, 15:00, A, B cloud merge (Fig. 5b), MCC began to MCS Evolution, to 16:00, two clouds merge all outflow boundary (Fig. 10d), this time MCC fully evolved into MCS. It documented that, when the two clouds merge, often triggering violent weather, while the active part of the convection system generally has a sudden change of edge Genting temperature gradient of about. By analyzing the position change convective clouds found that the most vigorous convection, resulting in severe weather cloud top temperature gradient is the place where the greatest change that at C in Figure 5d. Combined with automatic station hourly rainfall data analysis shows that, in Kuandian County at this time is the second heavy rainfall process moderate intensity maximum time. 17:00 later, with the cold front eastward and northward, cloud moves to the northeast, the intensity gradually weakened until it dissipated.

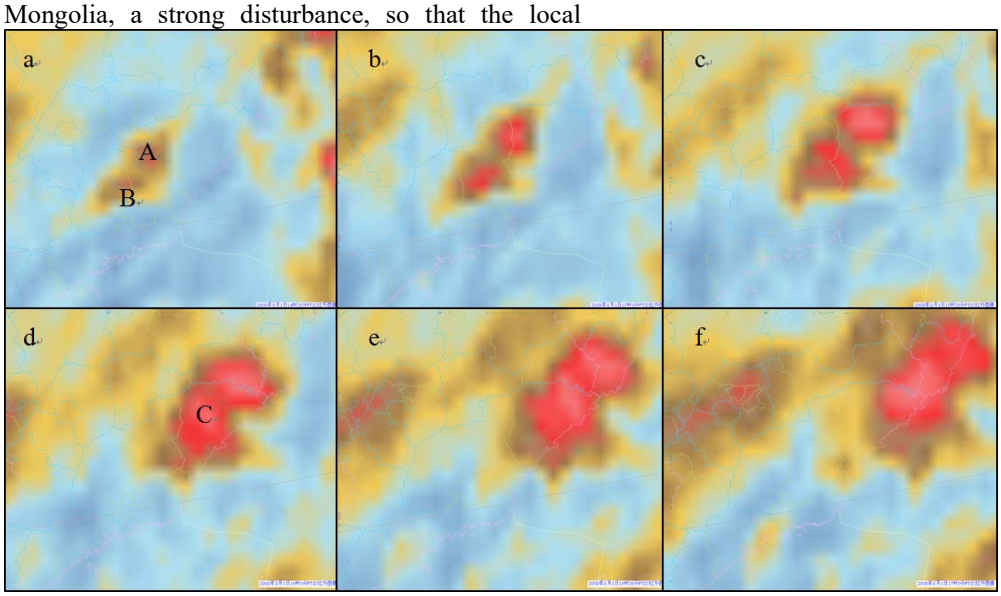

Figure 10 August 1 14: 30-17: 00 and a half hours FY-2C satellite infrared

D. Mesoscale terrain

Relationship between rainstorm and the terrain more closely, all over the country to the big summer rainstorm day rainfall distribution and frequency distribution are affected by the terrain. Ascending motion in large scale, if there exists a small hill, the hill that rises caused by terrain can enhance the movement of large-scale upward motion. From the topography of the city of Dandong, the whole terrain decreased gradually from northeast to southwest. The heavy rainfall across the region Heavy heavy rain, while the northern mountain town of Kuandian County Okawa heavy rain reached, indicating that the terrain factor in the heavy precipitation process plays a significant role.

Geographically, Dandong City is located in the Liaodong Peninsula in the heart of the bell, when the bell inside the prevailing winds coming down towards contraction terrain often cause convergence ascending movement to strengthen and rainfall increases. The precipitation process is too large rainfall eastern towns close to this factor.

4. CONCLUSION

In this paper, the use of conventional meteorological data, satellite image data, automatic meteorological station ground encrypted data, analyzes the 2008 July 31 to August 1 in Dandong appear to a big rainstorm, and focus on the process of large Effect of scale and mesoscale systems affecting the system are analyzed, draw the following conclusions.

(1) Western Pacific Subtropical rear boot southwest airflow, tropical depression north diffusion surface cold front and the front of weak cold air, low-level jet of water vapor transport is the main impact of the large-scale circulation background of heavy rainfall .

(2) the heavy rain during the more obvious mesoscale dew point front and on the ground in the presence of the cyclone, the dew point indicates that the mesoscale cyclone front and the ground system is important in the scale of the heavy rainfall.

(3) on satellite image analysis results show that the heavy rainfall, which organized mesoscale convective systems (MCS) from the occurrence, development, maturity to dissipate with the typical life cycle characteristics; by further analysis of convective clouds position changes found that the most vigorous convection, resulting in severe weather cloud top temperature gradient is the place where the greatest change; in addition, MCS occurrence, development, maturation and dissipation of heavy rainfall nowcasting warning has a more important indication.

(4) Special Terrain Dandong in the region of the precipitation increase has played a role.

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Discussion on Problems and Measures of Energy Saving Management in Institutions of Higher Learning

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Abstract: Institutions of higher learning can not only directly train personnel and influence people in all aspects as well. Energy conservation is a long-term strategic policy for China's economic and social development and the construction of Institutions of higher learning's energy saving relies on scientific development view by government. The establishment of a harmonious society is a long-term planning. According to the present situation, managing personnel, teachers and students are lack of the energy-saving consciousness and hydropower regulations are imperfect. This paper analyses the problems existing in College energy consumption and the problems of energy saving in institutions of higher learning, then putting forward the electric energy saving measures.
Keywords: Institutions of higher learning, electric energy saving, regulation measures

1. INTRODUCTION

The electricity situation in institutions of higher learning: the electric power consumed by the university consists of the electricity of the teaching and scientific research, living electricity and infrastructure electricity and etc[1]. In recent years, major colleges and universities continue to expand the scale of enrollment, the expansion of the new campus, improving of the teaching facilities and teaching conditions[2]. With the development of the scale and strength of colleges and universities , increasing energy is consumed by the teachers and student[3]. Chinese universities generally adopt opening student management pattern of no fixed classroom and no fixed seat during the absence of lessons with student learning by themselves[4]. Although it is convenient for students learning but also brings energy waste. As for night, the positions of students in the classroom are very scattered. Sometimes there are only two or three students in a classroom with all the fans and the lights open in the whole classroom[5]. According to statistics, the annual cost of water and electricity has reached 10 million yuan with the lowest level of millions of yuan. The potential of water and electricity saving is very optimistic.

2. ANALYSIS OF THE CHARACTERISTICS OF ENERGY CONSUMPTION IN INSTITUTIONS OF HIGHER LEARNING

A. School Buildings and Dormitories' Electricity Consumption Accounts for Relatively Large

According to the survey report, Chinese universities generally adopt opening management mode, the main activities of the faculty and students are in the teaching buildings and dormitories. Chinese universities generally adopt opening student management pattern of no fixed classroom and no fixed seat during the absence of lessons with student learning by themselves. Although it is convenient for students learning but also brings energy waste. Sometimes there are only two or three students in a classroom with all the lights open. The several kilowatts or even more than ten kilowatts staircase electric boiling water furnaces are open 24 hours a day, students and staff are lack of energy saving consciousness. Take a university of more than twenty thousand students as an example, according to the statistical analysis of relevant data: an average of two lighting fluorescent lamps in a bedroom is 60 watts, from 8 am to 4 pm, if these no need lighting every day will still turn on, power consumption is 0.48 degrees every day; the power of a computer with an average of 300 watts consumes 0. 9 power degrees of 3 three hours' open. All about 3000 bedrooms, each bedroom with four computers, according to the each student's school year to nine month, there will be nearly 330 million kw*h of electricity waste a year down. Every degree of electricity costs about 6 cents, only college dormitory each year will have a waste of nearly 200 million yuan.

B. Office Buildings Account for a Large Proportion of Electricity

According to the survey, each normal university has at least an office building, because the power consumption of the university office is not combined with the interests of the users, it results in great waste: most of the staff do not pay attention to the energy saving of office. All kinds of electrical appliances cannot be timely closed. Lamp burning phenomenon in the survey of colleges and universities everywhere resulting in a large waste of resource.

C. Air Conditionings Have Large Power Consumption

In the calculation about electricity waste: the author found that although in a year air-conditioning in the use of time is not more than half a year, it is about half of the electricity consumption is in the investigation. Many uncontrolled opening air conditionings cause the great waste and the office, laboratory and activities room air conditionings are often uncontrolled open. After a rough calculation, the air conditioning with power 1000W, every night 4:00 to early the next day to 8:00, if you forget to close, each office every day

will waste 16 degrees electricity and about 4000 degrees per year. Each school with 300 offices waste 130 million kw*h of electricity each year.

3. THE PROBLEMS IN POWER SAVING OF INSTITUTIONS OF HIGHER LEARNING

A. Power Saving Awareness is not Strong

Institutions of higher learning is the main power consumer and large faculty, staff, students are major participants of colleges. Their awareness of energy saving, energy-saving attitude directly affects the level of energy saving awareness in the whole society as well as modeling and guiding the whole of energy-saving atmosphere. In the investigation of several universities by the author, School media such as newspaper, campus network are lack of water and electricity saving, safety with electricity. It is the cause of the reasons for the low water and electricity saving management effect.

B. The Management System of Electric Energy Consumption is not Perfect

The responsibility is unclear, the system is not perfect. The separation of beneficiaries and the responsibilities results in serious waste phenomenon. Many schools have no special power management department, but assigned to the logistics department. Because of the logistics management department only do the statistical data of water and electricity consumption and daily maintenance work. The logistics management department has no financial power and their work is only for hydropower cost accounting, the remaining work handled by the financial department. The hydropower waste doesn't realize accountability for beneficiaries and stakeholders, which leads to the separation of beneficiaries and responsibility of university internal bearer, which leads to serious resources waste phenomenon appearing frequently.

C. The Structure of Energy-Saving Facilities in Colleges and Universities is not Advanced

The advanced hydropower facility is an important part of campus energy-saving operation supervision system. Most of the universities at present are in constant expansion, a large number of funds to the construction of the new campus, remains the shortage of old campus development. The old campus facilities, aging hardware facilities and high energy consumption operation cause serious hydropower waste. Facilities cannot be completely transformed, non-human factors of serious waste of resource. A considerable part of the old campus dormitory still use mechanical electric meter, whose measurement appears much error comparing to the actual energy consumption, and unable to implement central control and management, causing inconvenience to the tariff collection work. According to the survey, inaccurate measurement misleads pre-accounting. As a university of more than about 4.4 million degrees in 2006 with copied electricity to more than 3.9 million degrees, which cause the loss accounting of 590 thousand degrees. It is a great loss to the manager.

4. Energy saving measures for the use of electricity in Institutions of higher learning

A. Strengthen Publicity and Management Efforts

Cultivate college student low carbon saving consciousness and social responsibility. Our managers of colleges should set themselves as example, positive guidance, strict management from the little things and details. First of all, trade unions, the Communist Youth League, students and other organizations, can regularly organize some publicity and technological innovation activities for energy saving as the main content of the activities so as to implement energy saving as themselves. Then the campus network, newspaper, radio and other campus media can make such topics, column, energy saving & other activities, strengthening energy saving and safety education and curve the concept of saving water and electricity and in the heart of the teachers and students. The energy saving should become the conscious action of teachers and students, then the requirements of creating energy-saving colleges and universities can really be effectively implemented.

B. Establish and Implement Energy Management System

Establish specialized hydropower management in the logistics department and give hydropower manager the right of monitoring, inspection and punishment and evaluate their work performance. Secondly, require hydropower management personnel to implement water and electricity inspection system of the sites, teaching buildings, office buildings, laboratory buildings and public places. At the same time, install smart meters and water meters in the student dormitory and establish reasonable water and electricity costs charging system. Thus put an end to 'people go with lights eternal and water flows whatever' phenomenon.

C. Establish a Network Monitoring Platform

Install the digital transfer function measurement meter in the tail end of hydropower equipment to gauge the collected digital signal long-distance transmission by the monitoring center and through the energy monitoring software to realize campus energy consumption monitoring. Monitoring in real time by monitoring platform can not only view the data but also timely find the point of failure, providing a basis for the energy consumption data of faculties and departments.

D. The Use of Energy-Saving Environmental Protection Facilities

Making full use of the new technical energy-saving products, promotion of new energy-saving technology and energy-saving equipment in the production of daily life can be realized by using the automatic induction lamp, auto lights, energy-saving lamps, automatic power-off of intelligent lamp according to the light intensity to save lighting electricity. Public library and classroom which need higher lighting rate can be transformed into energy-saving fluorescent lamps and infrared induction control system. Thus not only realize "people go lights, stop wasting", but also

reduce the line loss and improve the utilization efficiency of the power supply facilities. The canteen boiler adopts the new energy-saving integrated meal kitchen cabinets and energy-saving effect can reach more than forty percent. The installation of time as well as light control equipment in public places of campus and intelligent power control system in the dormitory is used to save electricity.

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The Research on the Multi-Protocol Gateway

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Abstract: Adopting the method of combing wired and wireless communication network can promote the information construction for grain depot. However, the development of heterogeneous network brings many incompatible problems at the same time of convenience for the construction of grain depot in information. This paper studies the multiple protocol gateway based on IP protocol conversion method, realizes the connections based on IP network, and proposes a solution based on virtual IP technology for the non IP network access gateway, in which the the ZigBee sensor network and Ethernet have been discussed as examples and the test of multiple protocol gateway has been carried out systematically.
Keyword: IP protocol; gateway; protocol transition

1. INTRODUCTION

Grain is an important strategic resource for the national economy and the people's livelihood. In the storage of grain, measurement and control system for grain situation is the basis, and the construction of large grain reserves also increasingly require a high quality of grain condition monitoring system. Most of the existing grain storage measurement and control equipment is based on the wired network technology in which the installation of complex in the warehouse, maintenance and management costs are high. The latest research introduces the IOT technology into this system. Networking applications in the field of storage has been taking shape, and many sub terminal system has been in the granary of examination of the actual work, including grain monitoring, mechanical ventilation, recirculation fumigation and generation of grain storage and other. But the differences in various regions of grain storage site requirements and equipment manufacturers make grain monitoring system form a variety of coexist control networks such as the fieldbus, wired and wireless network, which leads to that the control network standards are not unified and that the equipment is incompatible. The grain monitoring data can not form effective data analysis. This paper designs a multi protocol gateway for grain monitoring using the latest technology and existing equipment implementation in grain depot to control network compatible solution. The multi protocol gateway conversion method based on IP protocol, is based on IP network interconnection between, and for non IP network access gateway, which gives the solution caused by grain depot acquisition equipment different communication modes caused by data acquisition system conflict.

2. PROTOCOL CONVERSION FUSION SYSTEM

Protocol conversion is the key and difficult technology for grain storage, and multi protocol storage grain gateway needs to realize the core functions. Because most of the upper layer protocol of the communication network adopts the TCP/IP protocol in which the data format of the IP protocol is used as the standard information packet format in the gateway, and the protocol conversion and data forwarding are carried out in the network layer.

According to whether the network layer adopts the IP protocol or not to access multi protocol storage, grain monitoring gateway network can be divided into two categories: the first is like WIFI, Ethernet, 3G based on IP network, and the network equipment uses unique IP address identifies in which the resource searching and data transmission are dependent on the IP address of the server, router and terminal network equipment which regards the IP address for the center of the interconnection network. Such a network is different only from the data link layer and physical layer data frame format, and only needs to packet and repackage the data link layer. The second scenario is that wireless sensor networks like ZigBee have their own network layer protocols, i.e., non IP networks. Such network equipment uses their special ID as the identifying address. Therefore, such a network protocol conversion, in addition to the need for analysis of the first case and repacking, also needs the virtual mapping of ZigBee network address and IP address, namely through the virtual IP technology realize non IP network access protocol grain monitoring gateway. The following two cases were analyzed.

2.1 Research On Multi Protocol Conversion Based On Ip Netwoek

The IP protocol allows devices in different physical networks to communicate with each other as if they were in the same network. In this way, different types of networks can be connected with each other through a router, and a "virtual network" is set up. But the actual data transport occurred in the second layer, in the layer using data frames transmitted through the physical network, the router will message from a network to transmit to another network, until it reaches the receiving devices where the destination network. In addition, the new "virtual network" by several technologies is not the same network, and each network has its own "physical address" type (such as Ethernet has 48 address, Net Arc 8 address). Therefore, IP should provide a common programming mechanism for the entire virtual network, so that each device can be addressed in the same way.

As a result, there are two different network addresses

for each device: physical address for the local physical network and IP address for the virtual network. The physical address is used to transmit data frames in the local physical network; the IP address is used to transfer the data from one network to another. When the source device already knows the protocol address of the destination device, the broadcast mode is used to send a packet containing ARP message frame to obtain the physical address of the destination device. Owing to sending broadcast frames, all equipment in the network will receive the ARP message which contains the source device IP address (address protocol). After all devices receive ARP frame and carries on the analysis, the device with the target protocol address will send a reply message to the source device and in the response message to send equipment hardware address. After such a ARP frame request and response process, both sides of the device will know the other physical address and IP address. Fig1 shows that the IP address of the address is converted to the ARP message format.

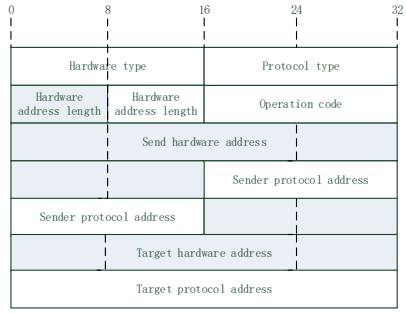

Figure 1 Conversion IP address and the Ethernet address of ARP packet format

ARP protocol processing procedures is mainly for processing the ARP table. First, initialize the ARP table, process the incoming ARP request and follow the new ARP table. Enter the ARP response frame processing function and judge the protocol address is the local IP or the target IP. If the request is to us, then reply to our MAC address. Search for the association in the ARP table, and complete the analysis of the parse request. In the end, it is required to maintain the ARP table, which is to update the timeout value for each item, and then check the validity of the article. If an item is timed out, a ARP request is generated to update the data. The specific ARP response process is shown in the following Fig2.

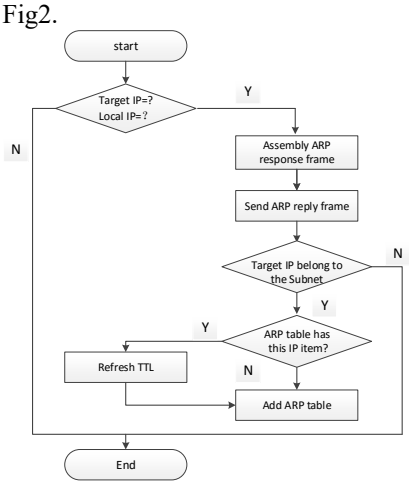

Figure2 flow chart of ARP reply

The IP protocol is also based on layered design idea. IP architecture design isolates the network layer protocol from the underlying protocol, which makes a single IP network can span like Ethernet, WIFI, 3G networks and other underlying media operations. Therefore, in the absence of any additional equipment and external mechanism, the network based on IP protocol can also work across the wired and wireless link layer. That makes the IP network base on a certain interoperability. In addition, the IP architecture is originally designed for following the end-to-end principle, and the application layer protocol is separated from the underlying network protocol. Therefore, the network is only in the end of the transmission between the data, and does not contain any application level information, that is, the application layer function can only be controlled by the network endpoint. So the network based on the IP protocol only needs to exchange data in the network layer and transparent transmission IP data stream. Take the following WIFI (802.11b protocol) and Ethernet (802.3 protocol) protocol for example, and the WIFI module and Ethernet module conversion process are as follows.

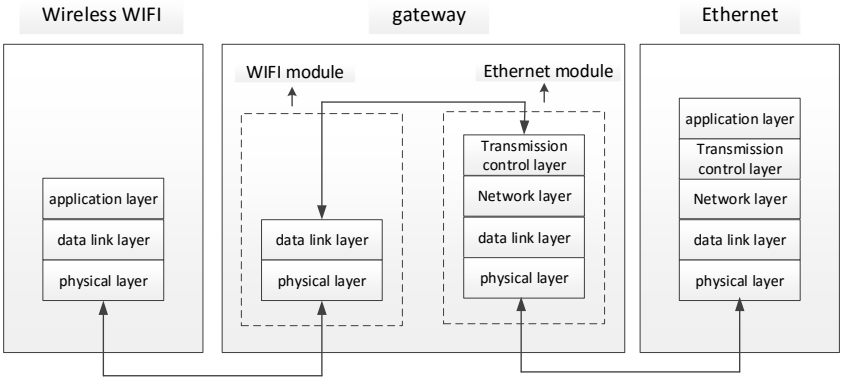

Figure 3 WIFI module and Ethernet protocol conversion

In order to enable the IP layer to complete the work, it is necessary to have the following functions: IP layer receives data from the upper layer protocol, the data must be transmitted to the lower layer of the protocol stack in order to transport through the LAN or WIFI and other links. In order to enable the IP layer to work correctly, the source and destination address segment and the control field are included in the data before the data is sent.

Slice / from the group: owing to the IP layer depending on different underlying transport media messages are sent, and the underlying protocol technology may frame length limit, so IP must have a mechanism to allow to adapt the limitations of these different dimensions. The mechanism is called divided. Of course, at the end of the destination, these slices must be reformed the original message.

Preparation: LAN in all the equipment has a unique address (MAC address); IP network in the host also must have a unique address (IP address). In addition, to facilitate the delivery of IP data reported among the remote hosts, it is necessary to adopt a convenient way of preparation, so that it is easy to identify the network and host. Delivery and routing: IP layer is responsible for "virtual network" on the delivery of the message. IP layer on the router must decide when and where to deliver the IP data to other networks.

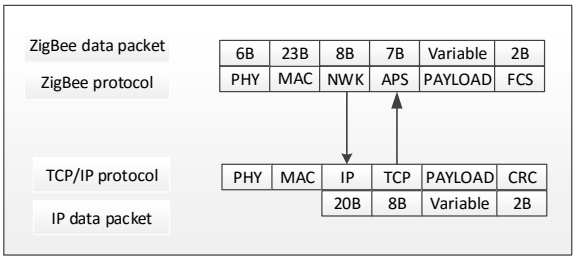

Figure 4 ZigBee protocol and TCP/IP protocol conversion

2.2 Internet Access Gateway Based On Non Ip Protocol

With the implementation of low cost, low power consumption, and low rate of LAN technology in grain depot, wireless sensor networks such as ZigBee will provide more reliable and extensive coverage in the future. ZigBee protocol inherits all the advantages of 802.15.4 protocol, and has its unique networking capabilities. But the ZigBee network uses the internal agreement to carry on the correspondence, and cannot directly connect the Internet network based on the IP agreement. In order to realize the ZigBee wireless network access IP network, this network adopt the virtual IP access technology.

The design idea of virtual IP network is mainly through the multi protocol mining gateway platform to map the ZigBee self organizing network as a virtual IP network. Users with the help of PC can carry on the management to the platform and the gateway. Taking the access gateway ZigBee nodes (including the coordinator node) as virtual IP nodes, the same as WIFI and 3G network nodes, it can access the ZigBee nodes through the IP address. In the ZigBee network, there is the unique ID identification number, which is the information exchange between the nodes and the nodes through the ID. Therefore, when the node identifies the ID and IP addresses to establish a pair of maps, the user can fully map the IP address and the need to access the Bee Zig network node to establish a connection and communication. These nodes which are based on the virtual IP technology together constitute a virtual IP network, which can be regarded as the extension of the entity IP network.

Protocol conversion implementation

For non IP network access to the gateway, in addition to solve the IP protocol to isolate the underlying media data frame, and to achieve transparent transmission, the key technology is to solve the non IP network address and IP address between the mapping problems. This paper takes the references of the address resolution protocol (ARP), and add the ZigBee routing table control procedures in wireless Zig Bee module to establish and maintain a address mapping table like ARP, in which the Linux system dynamically invokes the mapping table by ZigBee network in each network node ID and the dynamic allocation of IP address one-to-one mapping, and then dynamically updates the mapping table. This gateway maps each sensor node ID and a IP address, which makes users can directly manage the IP address throughout the ZigBee network access. The ZigBee wireless sensor network uses 16 bit short address ID to identify the node. When the equipment needs to join the network, router or coordinator will dynamically allocate 16 bit short address to the network, and network equipment also depend on the only address ID to communicate with each other. The establishment of the ZigBee nodes 16 bit internal network address and virtual IP address mapping table and mapping table of the software interface can be processed in ZigBee controlling program of routing table, which can achieve the mapping between ZigBee protocol in the IP address and the ZigBee node MAC address. The corresponding relationship between the ZigBee protocol and the TCP/IP protocol is shown in figure5-6:

3. GATEWAY SYSTEM ANALYSIS

To test the validity of the gateway design, this paper test the function of gateway communication conversion and communication packet loss rate. For the communication conversion function test, the amount of communication data with the site operators constantly changes. Therefore this paper does not describe the amount of communication data.

3.1 Multi Protocol Gateway Packet Loss Rate Test

In network communication, packet loss is a normal phenomenon, and a small amount of packet loss will not affect the quality of the network. However, when the packet loss rate reaches a certain percentage, it

will affect the normal operation of the network. This experiment uses 30 bottom sensing devices to carry out the network packet loss rate. Adopting the two rule, the data packets are sent to the multiple protocol gateway for long time using different rates. For example, network tester first extract the average rate from the maximum value and the minimum value as the sending rate. If in the testing process the packet loss rate is 0, extract the sampling rate of the maximum value and the rate value of average rate as the sending rate, and otherwise take the minimum value and unpassed rate value of average transmission rate. According to the number of data packets sent and received by the network tester, the packet loss rate of the multiple protocol mining gateway is calculated. Tab1 shows a multiple protocol gateway packet loss test results.

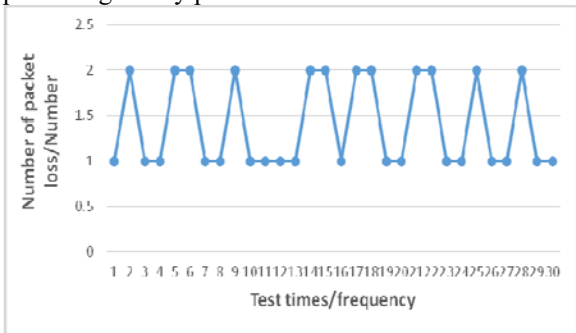

Table 1 The gateway packet drop test

As far as possible in order to approach the practical situation, account the packet loss when gateway nodes receive 2000 data packets. The average packet loss rate of multiple protocol gateway is less than 1%, the maximum packet loss rate China Communications Standards Association (CCSA) provides.

3.2 Multi Protocol Gateway Transaction Processing Time Test

Multiple protocol mining gateway uses version 2.6.32 Linux kernel system, in order to meet the requirement of real-time data sharing, a gateway adopts the SP - the strict priority queue scheduling algorithm. When the high priority queue is empty, then send the lower priority queues the packet in the queue scheduling. When SP is strict in accordance with the priority from high to low order, send priority high priority queue packet.

The multiple protocol gateway in Linux system is reasonable to cut and delete the dull drivers, in which the transaction time has greatly improved compared with the single protocol integrated access gateway. When the gateway is in normal work, send a data to the gateway in every 120 seconds, and record the time to return the data to compare, and test the 30 sets of data. In transaction processing time, multiple protocol mining gateway requires an average of 0.98 seconds, and single protocol integrated access gateway average at 1.27 seconds. Therefore, in the transaction processing response. In this paper, the multiple protocol gateway we study has improved significantly. Test results are shown in Tab2:

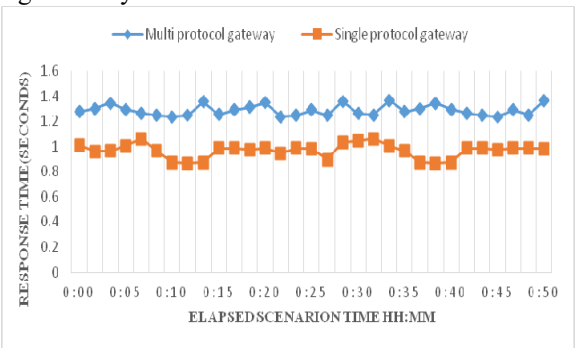

Table 2 Test result of gateway transaction time

4. CONCLUSION

This paper analyses the characteristics of heterogeneous network protocol. Multiple protocol gateway communication model was established, and the coal mine multiple protocol gateway is based on IP protocol conversion method to realize the interconnection between the IP networks. This paper also gives the solution for non IP network access gateway were Internet based on virtual IP technology, illustrated by ZigBee sensor network and Ethernet. Finally, the test to the multiple protocol gateway is systematically carried on. In addition, this paper also compares and analyzes the communication quality and communication speed between the single gateway protocol and multiple protocol gateway in grain depot. Experimental results show that multiple protocol gateway communication has higher conversion efficiency.

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About the Exploration of the Safety incidents which the Mining student encounter in Post Practice

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Abstract: The Post Practice is a part of the teaching procedure in mining professional, and theory change into practice, deeply understanding mining theoretical knowledge in the practice procedure , a transition which student from schools to enterprise. To this end, Post Practice,which is indispensable the Practice teaching procedure.But it is particularity and High-risk, Safety incidents ofen take place, therefore, Elaborate the reason of Safety incidents in the practice procedure, and find way of solving the problemthe.
Keywords: Post Practice;Safety incidents;Reason

1. MINING PROFESSIONAL FIELD WORK SAFETY ANALYSIS

Field work is replaced in the graduation practice of a kind of applied talents training mode.It is the combination of universities and enterprises a teaching link, causes the student to in-depth enterprise, grass-roots level, deepen the theory knowledge and practical experience, can better develop the students' practical ability and professional ability.But in recent years, in the process of exploring work, safety accidents occur frequently, and highlights the create positions internship with some problems in implementation.

As a "high-risk" industry of coal mining enterprises, the whole country , take place all sorts of mine accidents every year. Coal mine accidents, there are reports of students casualties, which make students, the school and parents bear heavy pain and pressure. For the accidents, students in the field work, security problem is mainly manifested in the following aspects[1].

1.1 Sudden Accident

For high risk of coal mining enterprises, for the management of the enterprise to the negligence of sex or the "wrong" behavior in the process of production, lead to gas and coal-dust explosion accident, roof weighting and so on. As a field work of the students, because social practice ability is very limited, in all aspects and society, there is still a gap between actual ability, safety consciousness, the ability to identify risks is not enough, no more accident experience and the experience of dealing with accidents.When facing a sudden accident, can appear panic no chapter, overwhelmed, this and no security exercises at ordinary times also has a certain relationship, when students to meet the real sudden accident, will can't escape.

1.2 Management of "blind spots"

Students in the field work, because of the particularity of identity, after stepping into the enterprise, the school think that the internship make the safety education and management to students. In field work ,students are the double identity, first of all, they are the student, and they are also a part of an enterprise, but some internship companies don't think the safety of the students by their responsible, this will give students management in a vacuum, the school is in front of the student internship for safe mobilization meeting, didn't really go to the scene where emphasis is the place that students should pay attention to safety, and enterprises think field work of the students is not the staff of this unit, so don't want to spend time and money to manage students,, because students just to unit internship, is not really the enterprise rights of employees. This situation is bound to cause some safety accidents, then schools and units will pass the buck.[2].

2. CAUSE ANALYSIS

2.1 Teacher Factors

Teaching is the main job of teachers, some teachers only pay attention to theoretical teaching, neglected the practical teaching link. Penetration in the process of theoretical teaching, rarely or combined with safety knowledge and experience of teaching practice, the students understanding of the production safety of coal mining enterprises rarely, safety awareness is very weak.In field work, the grouping of students school field work will be assigned to the teacher, but the teacher accompanying bear the theoretical teaching content at the same time, the field work led to guide teacher is useless.In field work, students is no supervision, Teacher's inaction, safety consciousness of student is very weak, there is great potential safety in the internship.

2.2 Enterprises Factors

(1) The current coal economic situation is good, the number of students rise every year, intern students in the less manpower and financial resources of the security ,is now even less. Again, field work of the students, not for enterprise to create value, benefit, during the internship, the talent which they need, even is a talent that after graduation for its service, so coal enterprises attaches great importance to the

safety of the internship students is far from enough. Don't get the benefits of coal mining enterprises, will not put energy and money into in cannot create value for the unit and the interests of the intern students.

(2) coal mine is a high risk, in field work, if security problems in the process of practice to students, some internship companies don't want to take the security risks in the process of the students.

2.3 Students Factors

The special coal mine working environment is the hard industry, students in practice, can not adapt to the special environment of the "dark", and in addition, they are young.Again, the coal mining enterprises and school to practice to learn a perfect safety education and safety awareness training, but let the security awareness soon can not "flipping" in mind, also is impossible, which need long-term work experience. Identify security risks and emergency handling way, the school and the enterprise must be responsible to the student, and for benefit of.the students,to train in the safety and processing ways, safety guidance practice while work, which has more effectiveness.

3. THE SOLUTION OF THE SAFETY ACCIDENTS IN PRACTICE

3.1 Strengthen Management In The Whole Process Of The Work

The management mainly includes the advance preparation stage, practice stage and summed up after the internship, in the preparation stage, survey the virtual enterprises ,and communicate with the internship enterprise, old staff train to student in the internship enterprise.Second in practice, the school and the internship enterprise must often contact, paying attention to students safety awareness and dynamic. At last, the students make evaluation and summarized,practice enterprise make induction and summary[3].

3.2 Strengthen safety education, establish the consciousness of "safety first, prevention first"

According to different virtual enterprises and the location of the internship, to develop different safety education content, especially the practice of safety education to field test before, students consciously to know to practice there are security issues only in this way, there is a risk.For some physical illness, security problems in the process of internship ,students are going to have contingency plans, attention to status of student, have contingency plans of the problem.

In the process of students field work, are not the formal employees of the enterprise, and can not enjoy some benefits of the virtual enterprises, but can the school security agreemen with the internship enterpriset,toclear their responsibility.

Safety accident reasons are various in mining professional field work, including the own factors of students, management function of school is bad.We should research to develop a suitable for mining, such as professional internship at risk management system and the field work of risk management system, ensure the personal safety of the students.

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Tourism Based on Hybrid Optimization Algorithm

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Abstract: Travel route optimization problem is the top issue of the current travel agency in that a reasonable arrangement of route could save a lot of time and money. Combining Dijkstra algorithm and Floyd algorithm, this paper adopts optimization algorithm of the shortest distance between two points - the hybrid algorithm. This method calculates the shortest paths among many points in the method of Floyd calculation, and chooses the other method of Dijkstra calculation when some of these paths change. The shortest paths and other paths contribute on the latest shortest paths among these points. Under these conditions, finally the shortest paths comes out. Through out the experiment,, hybrid algorithm is 14% and 16% percent more efficient than the Dijkstra algorithm and Floyd algorithm respectively.
Keyword: Travel route; Dijkstra; Floyd; shortest path

1. INTRODUCTION

With the development of the "world expo tourism year" in China, the people's material life level is higher and higher, and the domestic and foreign tourism increases significantly. In order to improve the service quality, and quickly grasp the business information, we put forward the travel route optimization problem.

Travel Route Problem (Travel Route Problem, TRP) is an important factor of modern tourism, if the design of the route is unreasonable, it will waste a lot of resources and time. With the growth of economy, it has been stricter and stricter to execute the route efficiently. Therefore, optimizing the tourist routes becomes a hot topic in the contemporary.

2. A MATHEMATICAL MODEL TRP PROBLEM

2.1 Trp Problem Description

If a tour group is to go to M tourist destinations which is located in q_i, and it needs k cars to all the destinations with each car carrying the largest number of P_k (1, 2,..., k) passengers, the vehicle circuit takes the minimum cost totally, and satisfy the following constraints:

1) There is only one departure place and one tourist destination.

2) Each car only take one route, and each tourist destination only need one car.

3) Any number of passengers on a route is no more than the sum of the motor load.

4) Each of the moving path is no more than the total length of the maximum distance of a car.

2.2 Trp Mathematical Model

If the distance from point i to point j can be bi, j i, j = 0, 1,... , M, $b_{0,}$ and $_0$ represents departure place, according to the travel route optimization problem description, a mathematical model can be established as follows:

$$\mathrm{MinF}=\sum_{k=1}^{k}(\sum_{i=1}^{nk}b_{r_k^{i-1},r_k^i}+b_{r_k^{nk},0})\times \mathrm{sgn}(n_k) \tag{1}$$

Among,

$$\mathrm{sgn}(n_k)=\begin{cases}1 & n_k=0\\ 0 & n_k\geq 1\end{cases}$$

(1) the constraint conditions for:

$$\sum_{i=1}^{n_k}p_{r_k^{i-1}}\leq \mathrm{pk}\ ;\ n_k\neq 0$$

$$\sum_{i=1}^{n_k}b_{r_k^{i-1},r_k^j}+b_{r_k^{nk}}\leq \mathrm{B}^{\mathrm{k}}\ ;\ n_k\neq 0 \tag{2}$$

$$R_{k1}\bigcap R_{k2}=\varphi\ ,k1\neq k2$$

$$\bigcup_{k=1}^{k}R_k=\{1,2,...,\ M\}\ ;0\leq n_k\leq M$$

In the formula above, B_k is the maximum distance of vehicle k, R_k is the collection of
all tourist spots vehicle k is driving to, r^j_k means the attractions in vehicles k line is in
the order of j.

3.ALGORITHMIC THINKING

3.1 Dijkstra Algorithmic Thinking

Dijkstra method to search the shortest path algorithm is as follows:

If DJ is the shortest path from starting point S to j, pj is the point before the point of the shortest path from S to j, and E is the end place, so the Dijkstra algorithm calculating the distance from starting point S to the final point E is as follows:

(1) Initialization:

a) Read the map data: Node data and line data

b) Set the starting point : $d_s = 0$, p_s is empty

c) All other points: $d_i = 0$, p_i is empty

d) Mark the starting point of the retrieval point S, k = S

(2) Search from all retrieved point k to the directly connected and unretrieved point j, so the shortest distance d_j can be:

$d_j = \min[d_j,d_k+l_{kj}]$

l_{kj} is the distance from point k to point j.

(3)Take the next point. Take out the minimum i from all unretrieved points d_j in:

$d_i=\min[d_j$, all unchecked j]

node i is the point of the shortest path, and will be marked as it has been retrieved.

(4)Find out the point before i. Find out point j * directly connected i from all the unretrieved points. Take it as the before point, and set:

i = j*

(5)Mark the points i. If i = E, the algorithm completes; otherwise, k =i, go to step (2) to continue.

3.2 Floyd Algorithmic Thinking

(1)Starting from the arbitrary unilateral path, edge weights are all of the shortest distances between every two points. If there is no edge connected between two points, the weights of the default value is infinite.

(2)For each pair of vertices u and v, and see whether there is a vertex made from u to w and to v, to make it shorter than the known one. If it is so, update it.

3.3 HYBRID Algorithm Thinking

Using Floyd algorithm to calculate the shortest path between the multiple vertices, if there is a certain constraint conditions which makes the path of the adjacency relations between the seldom vertices change, use Dijkstra calculation. The shortest paths and other paths contribute on the latest shortest paths among these points, and under these conditions, finally the shortest paths comes out. If the the vertex from v_i to v_j is the shortest path, and there is an arc between v_i and v_j, the weight point on the arc is a path, but not necessarily the shortest path, and it should be tested by n-1 times. First, add the vertices v1,Detection (v_i, v_1), (v_1, v_i) and test whether there is a path, which is below (v_i, v_j); If so, replace as the after two paths, which is called the shortest path that is no more than n. Again add vertex v_2, and get the shortest path in which the v_i to v_j intermediate vertex sequence number is not greater than 2. So, continue all the way until.vn is added, and get the shortest path in which the v_i to v_j intermediate vertex sequence number is not more than n.By now the algorithm comes to an end. Specific implementation process is as follows:

1)Floyd required for the shortest path algorithm is obtained, and a vertex have n G undirected graph, the weights of each edge is given .For calculating G m for the shortest path between the adjacent vertices.

①Establish a weight matrix W = [w_{ij}]; ②Find all greater than w_{i1} W + w_{1j} elements, w_{i1} + w_{1j} to replace them, get the new matrix W1 = [w_{ij}]; Find all greater than in the W_1 w_{i2} + w_{2j} elements, w_{i2} + w_{2j} to replace them, get the new matrix W_1 = [w_{ij}], so cycle, and the W_n, get the shortest path between all vertices in the graph.

2）To obtain the shortest path and tested: assumes that the starting point for p, q, straight is the shortest path length of W_{pq}, Path by the vertex is: p, 1, 2,... , i, j, k... , m, q. The edge of the path contains: e (p, 1), e (i, j),... , e (m, q). According to the following simulation implementation of the project, it is determined by actual problem inspection standards, and will be implemented into optimization schemes for the inspection of the shortest path. Inspection method is: in e (p, 1), e (i, j),... Test, E (m, q), if the paths of each edge meet the requirements of practical problems, then vertex p and q of the shortest path is correct, and algorithm is going to step 4). if not, it should continue.

3）Correct path e (i, j) by using the Dijkstra algorithm. If the vertex p to q one edge of the shortest path e (i, j) cannot meet the requirements of the actual problem, makes $w_{ij} = \infty$.

①The vertex i label is 0, and other vertexes are labeled ∞; vertex i is calibration, and other vertex for calibration;②All un-calibrated vertex gives a temporary label, and temporary label value is determined by the formula: temporary label for old label minx, old label w_{ij} (y), y is the first step has just been scaling vertices; ③Find all temporary label minimum value, and take it as the corresponding vertex of the label. If there are several vertices with the same minimum label value, and choose a calibration, and turn to step 2), until the end of the specified j is scaling, and get the the shortest path length from i to j and the path between the vertices, ifg... , r,... , j. Amend the shortest path length from vertex p to q and the path of all passed vertices, and test the path again.

4）Take the tested path as the shortest path from p to q, and repeat steps 2) ~ 4), until all the m pairs of the shortest paths come out.

4. ALGORITHM ANALYSIS AND IMPLEMENTATION

As it is shown from figure 1 with a weighted undirected graph, vertex Numbers for (1), (2),... , (20), every edge is given by even values. There are 158 adjacent vertexes in the graph which can form the 158 paths. Select vertexes (1), (2), (3), combining the rest of the adjacent vertexes, to form 47 pairs points. Respectively, use the mixed algorithm, Floyd algorithm and the Dijkstra algorithm to calculate the shortest path between them, and take account of the following constraints: At first, an edge e (p_m, p_n) of the path (p_1, p_2, p_3) whose weight is 11 and should not be allowed for the invalid edge; Secondly, in the 47 vertexes, three vertexes need to be joined the control points, referring to graph 1.

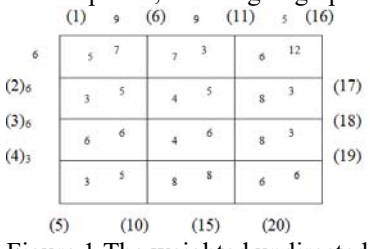

Figure 1 The weighted undirected graph

Table 1 Untested contains the control points of article 3 of the shortest path

origin	end point	constraint points	length	after a node

(1)	(13)	(3)	22	(1)(2)(3)(8)(13)
(2)	(18)	(8) (9)	29	(2)(7)(8)(9)(14)(13)(18)
(3)	(12)	(13)	14	(3)(8)(13)(12)

Hybrid algorithm calculation steps are as follows: according to the constraint conditions 47 of vertexes will be divided into two parts: the one is without control points with a total of 44 pairs of points, and the other is a controlled point vertex pairs with a total of three pairs; Secondly, according to the calculation process calculate the shortest paths both controlled points and uncontrolled points respectively, referring to the results in table 2. According to the constraint conditions, test the values and recalculate the uncorrected paths, referring to the results in table 3.

Table 2 upon examination unqualified path

origin	end point	length	after a node
(1)	(17)	28	(1)(2)(7)(12)(17)
(2)	(17)	22	(2)(7)(12)(17)

Table 3 by the path of the inspection

origin	end point	path length	after a node
(1)	(17)	31	(1)(2)(7)(12)(13)(18)(17)
(2)	(17)	25	(2)(7)(12)(13)(18)(17)

Floyd algorithm is used to realize the the shortest path algorithm to calculate N matrix D (1), D (2), (3), D... , D (n), in which each element matrix contains n^2, to work out all the vertices of the shortest path between them; Select the required 47 path and test them one by one. If an unqualified path is found, modify the corresponding element, recount all the vertices of the shortest path, and then choose the another one. Dijkstra algorithm in computing a point to other points of the shortest path needs two loops with iteratively n - 1. In each iteration a new node will be added to the temporary node setting. The number of nodes not in the shortest path is n - i, and namely the iteration i need to deal with n - (i) a node, so the required number for processing is $\sum_{i=1}^{n-1}(n-i)=\frac{n(n-1)}{2}$, Of n nodes in the network time complexity is O (n^2), and throughout multiple execution of Dijkstra algorithm the shortest path will come out. The example calculation results above shows that the hybrid algorithm combining the Floyd algorithm and the characteristics of the Dijkstra algorithm with a small amount of calculation and higher computational efficiency, realizes the higher efficiency, forming a shortest path algorithm with the bight future in calculation.

The calculation is based on the computer configuration of Pentium III550, the memory 512 M, and the hard disk 40 G. It can satisfy the general city logistics distribution to calculate the shortest path query. Dijkstra, Floyd and hybrid algorithm efficiency is shown in table 4 in which it can be seen that hybrid algorithm is 14% and 16% percent more efficient than the Dijkstra algorithm and Floyd algorithm respectively.

Table 4 Dijkstra, Floyd, compared with the hybrid algorithm efficiency

count	Dijkstra （s）	Floyd (s)	mixed algorithm （s）	Increase the proportion of (contrast Dijkstra)	Increase the proportion of (contrast Floyd)
500	0.37	0.39	0.26	16	20
2000	1.28	1.37	0.83	13	18
5000	2.20	2.23	1.62	17	18
10000	3.02	3.01	2.58	14	14
20000	5.01	4.65	3.86	17	11
80000	7.11	7.31	6.87	14	16

5.CONCLUTION

Travel route optimization is an important problem of modern tourism industry research. In the view of the defects of the contemporary calculation, combining Dijkstra algorithm and Floyd algorithm, a hybrid optimization algorithm can be applied to solve optimization problems in travel route optimization. After inspection, it greatly improves the efficiency of traveling, and is more able to adapt to the contemporary demand. It should also be needed for us to research a better method which is more effective to solve this problem.

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