

Animation Simulation of Visualization Management System in the Iron and Steel Enterprises: The Design and Its Implementation

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Abstract—With the rapid development of the computer and network technology, the visual management methods are applied to the business management. The research of visualization for management of the equipment, sales, production and quality, procurement and supply etc. is a hot topic in steel business management. In this paper, the authors study a data presentation of the visualization management system in iron and steel enterprises--animation simulation, analyze the different structure data resources to realize the information integration and focus on the animation technology driven by database. The paper expounds the realization of perfect animation effects by designing the reasonable animation database structure, introducing the principle of communication between the animation and the database, setting up the communication protocol between the database and the animation page, writing the universal code and animation script. The technique has been applied to actual project, it is proved that the system is stable, accurate data analysis, fast running speed, realize the visualization of information within the iron and steel enterprises.

Index Terms—animation simulation, visual management system, database design

I. INTRODUCTION

Visual management system refers to the information technology systems. It helps managers grasp the enterprise information effectively, achieve transparency and visualization management, make the management effect permeate into every aspect of enterprise human resources, supply chain, customer management etc, make the process of enterprise operation more intuitive, visualize the internal information, and enable the enterprise to convey more effectively, so as to realize the transparent management in enterprises [1]-[3].

The iron and steel enterprise visualization management

is the system that can track the orders and monitor the external conditions of the orders, combine the running status from the production plan for the main equipment of production process, the data of finished products and semi-finished goods inventory, and the quality inspection data to integrate information, track the production process and production results by using the information from coking, iron-making, steelmaking, rolling, cold rolled, energy and power, the material stock, the stock of finished and semi-finished products, quality control etc., therefore realize the centralized and efficient control of the whole cost process in the iron and steel enterprises, and greatly enhance the overall management level of the enterprises and the creation ability.

This visual system provides several presentations of data, such as the tables which can display search results and the report files, and the curves which can reflect the variation trend, and the histogram which can contrast data clearly, and the shape of stacks and the animation simulation which can reflect the current state etc. They are implemented by the query data module, the report formed module, the curve formed module, the histogram formed module, the shape of stacks formed module and the animation module that transfer motion control data and equipment operation parameters to the client[4]-[9].

This paper studies the design and implementation technology of the animation simulation, which show the animation on the screen in the control room or on the monitor of the client by using the Flash technology into animation design. The data between the client and the server are transmitted by HTTP packets. They come from the tables of animation database in the visual management system. Finally, the technology realize the real-time display of main equipment, such as iron-making, steel-making and rolling, operational state, display of the main equipment operation parameters, Real-time display of raw material vehicle, finished products vehicle into the factory, Real-time display of main materials inventory. It can not only achieve the effect of beautiful animation interface and reliable data, but also can provide convenience for the additional equipment and expansion

of the functions. The technology has been used in the project of the enterprise resources visual management in Tangshan, such as the visualization design for the steel plate co., LTD. It can not only make administrators in the dispatch room understand the situation and command productions reasonably, and can deal with emergencies in time. It also provides reference to animation simulation in visualization.

II. RESEARCH BACKGROUND AND THE AIM OF THE DESIGNED SYSTEM

At present, many management systems are deployed in iron and steel enterprises, but they can't work well together effectively. The main management systems include PLC(Programmable Logic Controller) production control system, EDNA(Enterprise Distributed Network Architecture) energy management system, metering system for the products come into factory or leave of the factory, metering system for internal transport, metering system for train pounds, metering system for roller pounds, MES(Manufacturing Execution System) for the rolling and ERP(Enterprise Resource Planning), from which data can be collected .The aim of visual management system is to integrate these existing resources scientifically, to get data from these resources and to let the system become the visualization system data provider . It gathers the data for visualization system regularly in order to supply data representation module by the way of collecting data. Parts of that data will supply animation simulation. Figure 1 shows the relationships of data:

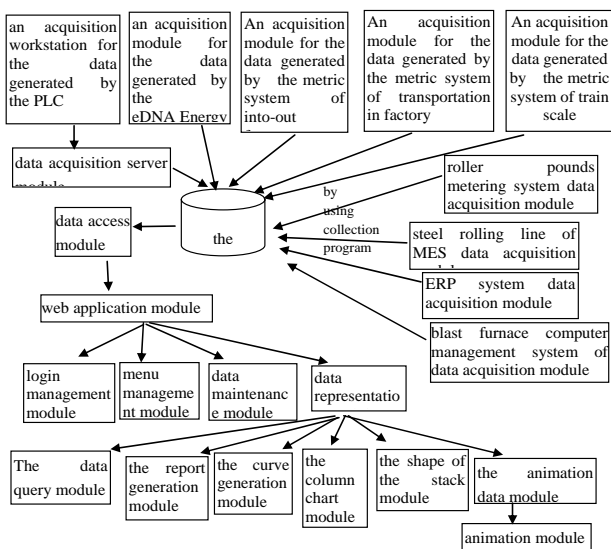


Figure 1. system module structure diagram, the arrows represent the main data flow.

(1) The data from animation tables support animation page. The animation tables mainly include animation parameter table, the current animation action and state tables. All the data in the tables come from the basic database by using database procedure, function , trigger of table, while the basic database data acquisition is from the original data of the enterprise information

management system through collection program. Some of the data are the results by the complex calculations or statistics among many tables.

(2) The data in the basic table are from the original information system of the iron and steel enterprises. In order to get the data in time and accurately, the data are the collections through data acquisition programs, the direct reading of the original database, and the transforming of the original data database with the aid of intermediate data sheet. The ways ensure that the new data will be collected by regularly and in time from the program when the new data are inserted into the original database. The triggers update the intermediate table immediately, while the data in original database are updated or deleted. The tables of visualization will be updated any time by the program when the intermediate table information is updated. They can ensure the acting parameters and postural parameter in animation table updated in time, so they can realize the animation simulation for main equipment action.

III. THE STRUCTURE DESIGN OF ANIMATION DATABASE

The structure of the Database will directly influence the efficiency of management information system. With reasonable structure, the data redundancy and storage can be greatly reduced, and the data integrity and consistency and the response speed of the system can also be greatly improved [10][11]. Figure 2 is the E-R diagram of animation data tables.

The animation parameters can be classified into many different classes according to the whole work flow of the

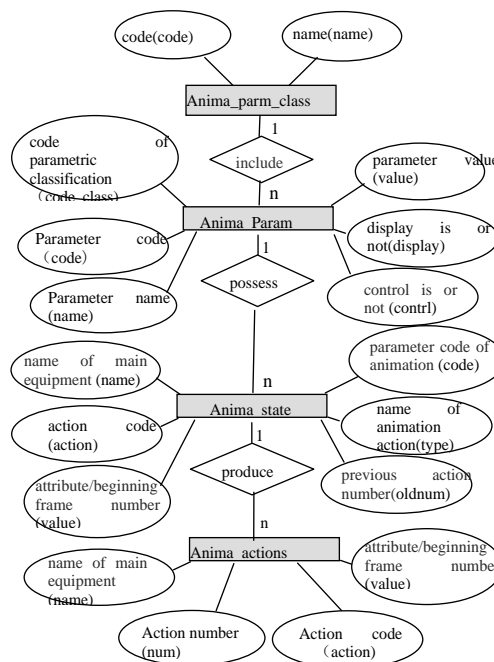


Figure 2. the E-R diagram of animation data tables.

enterprise, such as materials into factory and transport in factory, running state of sintering machine, stocks and sales of finished products. According to the control

function of the animation page, the animation parameters can be categorized into two classes, one is state parameter and the other is controlling parameter. The state parameter refers to these data that are needed to display on the animation page, such as the display parameters of the current inventory status, including the type display of steel of finished products, the number of each type, the weight of each type, the total number of the inventory stock, the total weight of the inventory stock. The control parameters are used to control the action of the instance in the animation. If a truck with many completed products is leaving the vehicle pound, a delivery car must be seen on the animation page. If a piece of the steel plate is being processed in the cooling bed, then the plate must be showed in the cooling bed on the animation page at the same time. The animation actions are controlled by animation controlling parameters. But if the license number of the truck, the types and specifications of steel plate, the number of each type of steel plate, steel plate net, the customer name and other information need to be displayed on the truck picture in order to represent the customer that the steel plate is produced for and the contract number, obviously, these data then are the state parameters. Therefore, the animation page need combine some data tables in the animation database to achieve the animation simulation effectively.

The action attribute in the action parameter table and the action attribute in the state parameter table are the same.

There are different meanings for the attribute values.

0 changing the attributive value.

1 play.

2 gotoAndPlay.

3 gotoAndStop.

When the value of action is 0, the value of the value attribute is assigned the name attribute.

When the value of the action attribute is 1, it means that the instance in the animation will be played.

When the value of the action attribute is 2, it means that the instance in the animation will go to the value attribute and be played.

When the value of the action attribute is 3, it means that the instance in the animation will go to the value of the value attribute and be stopped.

IV. THE STRUCTURE DESIGN OF ANIMATION DATABASE

A. The Principle of Communication between Flash Animation and Database

The ActionScript in Flash has powerful function and strong interaction. It can be read agilely by the other programming language. The Loadvars class in ActionScript is used to transfer variables between the application and the server. The load method in Loadvars class is used to load variables from the specified URL. The send method is used to submit variables to the specified URL. The sendAndload is the method which can send variables from the specified URL and load the variables from server [12]. In this animation environment,

the equipment data need to be obtained from the animation data table, so a page access to the database should be designed, which can organize some data needed by the animation action as driving animation variables, then the animation display page load these variables from the page. When the animation page displays some equipment running status, it also needs to access the database page to load variables, so that the equipment state information can be displayed in the animation page. The page access to the database is animation control page. It is named AnimaControl.aspx.

The file named anima.aspx is display page to show animation, the file named anima Control.aspx is a control page to provide data that control the animation and the state of equipment. The file flash.swf is loaded by the display page anima.aspx. Figure 3 shows the principle of communication among the animation web page, the data processing page and the database [13]-[15].

B. The Acting Controlled Protocol

The server returns a string using utf-8 format by the control page. The form of the string is similar to the form of the web request parameter: that is the form as "variable name = value" separated by the character "&". The format of possible variable name and the corresponding value is as follows.

(1) dataError: It means that when this variable appears, no valid data are acquired and there are mistakes. It is

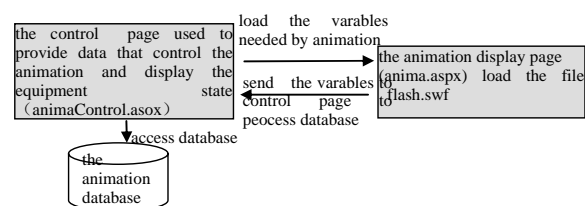


Figure 3. the principle diagram of communication between Flash and database.

described as a string with the error.

(2) updateTime: the variable is a string as the form of yyyy-MM-dd hh:mm:ss. It means the period of time of acquiring the data.

(3)The variable elapsed: The variable is a string type. It means the seconds during the time of the period from submitting the task to the data access module to forming the available data.

(4)The variable data. The variable is a string to control each equipment action. The string is divided into several lines. The delimiter "\ r \ n" (carriage return and new line character) are used to separate the lines. Each line controls an action object in the animation page.

Each data line contains three contents, which is separated by the delimiter ("t"). The first item is the name of the animation object, the second is the controlling mode of animation object, and the third is the controlling parameter. The value of controlling mode includes the following number:

The number 0 means that the controlling parameters are the animation displaying contents.

The number 1 means that the animation object plays from the beginning frame (play).

The number 2 means that the animation object go to the appointed frame and start to play (gotoAndPlay).

The number 3 means that the animation object go to the appointed frame and stop playing (gotoAndStop).

Figure 4 shows the AnimaControl.Aspx page transmit to Flash animation page to control the movement of equipment according to the above protocol.

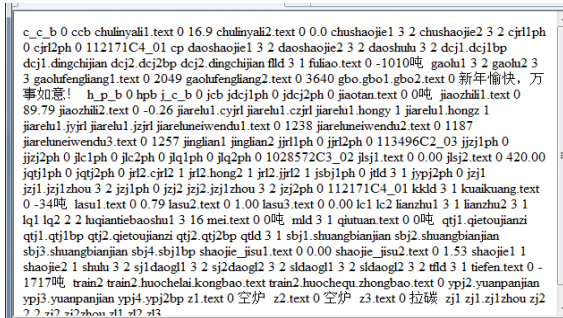


Figure 4. the principle diagram of communication between Flash and database.

C. The Equipment Operation Parameters Protocol

When the user clicks on main subject equipment, the Flash page will request equipment operation parameters from the server as the following string form:

AnimaControl.Aspx?qCode=aaa&p1=bbb...&p99=zzz

Inside the string, the string aaa is the query code representing a database query accessing equipment operating parameters in the dfn_queries table. The substring between the string "P1 =" and the character '&' is the first parameter of the query. It will replace the string "? 1" in the query, so the server can accept ninety-nine parameters to the query.

The server returns a string using utf-8 format by the control page. The form of the string is similar to the form of the web request parameter, that is the form as "variable name = value" separated by the character "&". The format of possible variable name and the corresponding value is as follows.

(1) dataError. It means that when this variable appears, no valid data are acquired and there are mistakes. It is described as a string with the error message.

(2) title. The variable means the following string is the query content title, as title of the parameter display window.

(3) colTitle. The variable means the following string is the title for each column which is separated by tabs ("\t").

(4) data. The variable means the following content is the lines which is separated by carriage return and new line character("\r\n"), the content for each line is the column content that separated by tabs("\t").

(5) colBytes. The variable means the following content is the maximum width, which is separated by tabs, for each column (bytes, an English character occupy 1 byte, a Chinese character occupy 2 bytes). This value is used as the basis for data window to adjust the column width.

D. Implementation of the Actionscript in Flash Animation

The animation display page requests the equipment controlling parameters every three seconds by visiting the animation control page AnimaControl.Aspx. First, it loads the data generated by AnimaControl.Aspx, and then analyzes the data with the ActionScript, so it can control the dynamic effect of the picture according to the main equipment name, the action numbers, the equipment action code, the attribute or the beginning frame or stopping frame. Figure 5 is a flow diagram for data processing, figure 6 is effect picture of animation.

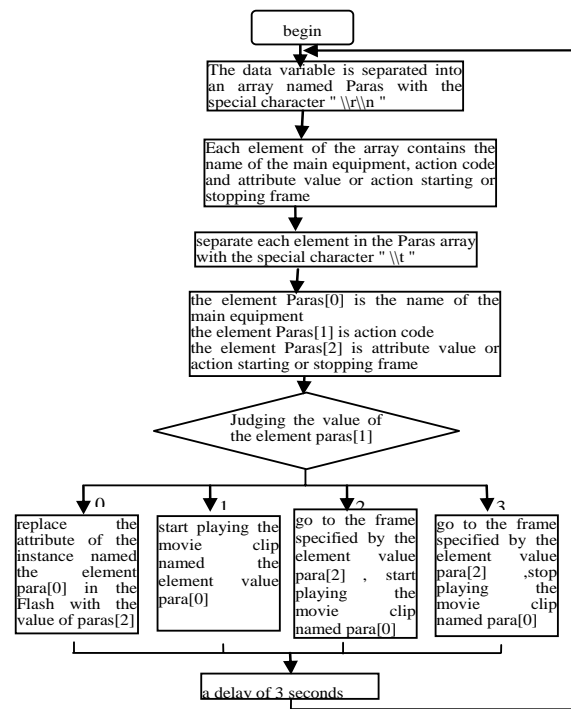


Figure 5. algorithm flow diagram of animation controlling data.

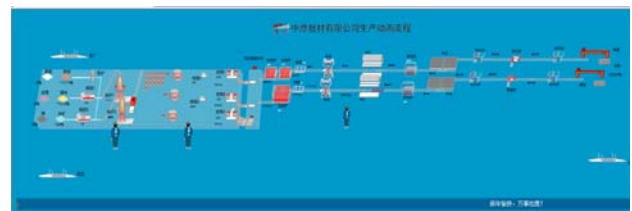


Figure 6. the effect picture of animation page.

the ActionScript code is as follows:

```
import flash.external.*;
var intervalId:Number;
intervalId = setInterval(this, "readdata", 3000);
var src:String="";
function readdata():Void {
    var result_iv:LoadVars = new LoadVars();
    result_iv.onData = function(src) {
        if (src != undefined) {
            var n:Number = 0;
            var i:Number = 0;
```

```

        var paras:Array;
        var para:Array;
        paras = src.split("\r\n");
        n = paras.length;
        for (i=0; i<n; i++) {
            para = paras[i].split("\t ");
            if (para.length<3) {
                continue;
            }
            if (para[1] == "0") { //chang the value of attribute
                if (para[2] != "") {
                    set(para[0], para[2]);
                }
            }
            else { // control the action of clip
                _global.mcAction = para[1];
                _global.startFrame = para[2];
                tellTarget (para[0]) {
                    switch (_global.mcAction) {
                        case "1" :
                            play();
                            break;
                        case "2" :
                            gotoAndPlay(_global.startFrame);
                            break;
                        case "3" :
                            gotoAndStop(_global.startFrame);
                            break;
                        default :
                            break;
                    }
                }
            }
        }
    };
    result_lv.load("http://localhost/animaControl.aspx);

```

V. SUMMARY

With the research and development of the enterprise resource visualization management project of Tangshan steel plate Co. Ltd., this paper studies one of the styles that can present the data in the iron and steel enterprises visualization management, called animation simulation. In order to cut down the cost, realize the management visualization and promote the ability in the enterprises, it analyzes the present situation with the system of informational management, defines the goals of designing and realizing system comprehensively, and rearranges the data resources. Secondly, it studies the communication mechanics between the Flash page and the sqlserver database, designs the reasonable database structure of animation and researches on the generality of the program code. When the animation page requires increasing an action or a parameter for a new subject equipment, it just needs to be added by an instance, and the animation data tables needs to be added the parameter

of the main equipment which has the same name with the instance in the animation page, rather than modifying the program codes which control the parameters. So it can improve the extensible ability for animation system. Finally, it introduces the communication between the animation page and the database, writes the script programming and simulates the animation effect. The research has been verified in the application. The results show that the system has the characteristics of accurate data, fast running speed and stable system. It can really realize the visualization of information in the iron steel enterprises.

REFERENCES

- [1] Wei guangke, "Research on information management system of human resource base on .NET", Computer Engineering and Design, (Editorial department of computer engineering and design), vol. 28 no.11, pp. 2682-268, 2012
- [2] Zhu Li, Su Hongye, Shen Qinghong, Lu Shan, "Study on secondary energy efficiency evaluation for steel and iron enterprise", Journal of Shanghai Jiaotong University, Vol.46, No.12, pp.1926-1930, 2012
- [3] Chen Xinxi, "Visual management and its practice F Co. Ltd.", Master's thesis, tutor Xu zhiDuan, Xiamen University, 2008,4
- [4] Jiuyuan Huo, Yaonan Zhang, "Long-term Monitoring and Visualization Analysis System for Permafrost Change on Qinghai-Tibet Plateau", Journal of Computers, Vol. 7, No. 8, pp. 1927-1934, 2012
- [5] Li Keichun, Zhang Kang, "Teaching computer data transfer principles through simulation and animation", International Journal of Applied Systemic Studies, Vol. 3, No. 2, pp. 149-167, 2010
- [6] He Weida, "improving the competitive ability of iron and steel industry allow of no excuse", China venture capital, 2011,4, pp.79-80
- [7] Liu Qingling, " The research on the enterprise accounting process reengineering based on the ERP environment ", Journal of Software, Vol. 7, No. 10, pp. 2196-2204, 2012
- [8] Sun Bai-qing, Jin Wei-quan, Jin Wei-quan, Wu Berlin, "Research on fuzzy dynamic evaluation approach for ERP benefits application in China ", Journal of Convergence Information Technology, Vol.7, No. 19, pp.479 ~ 486, 2012
- [9] Sun Li, Li Shugang, Tao Ying, Chen Huabin, "the design and implementation of quality management information system based on B/S mode", Journal of Shanghai Jiao Tong University, Vol 44, pp.175-177, 2010, S1.
- [10] Wu Shouyi, "The study on the communication technology in the Flash project and the database based on the ASP.NET", computer knowledge and technology, Vol.6 No.26. pp. 7383-7389, 2010,9
- [11] Zhengqiu He, Lifa Wu, Huabo Li, Haiguang Lai, Zheng Hong, "Semantics-based Access Control Approach for Web Service", Journal of Computers, Vol 6, No 6, pp. 1152-1161, 2011
- [12] Tao Tan, Hongjun Chen, "A Personalization Recommendation Method Based on Deep Web Data Query", Journal of Computers, Vol 7, No 7, pp. 1599-1606, 2012
- [13] Adobe company, Adobe Flash CSS ActionScript 3 Chinese version of the classic tutorial, People's Posts and Telecommunications Press, 2011, 11, pp. 23-82
- [14] Chen Qingzhang, Pei Yujie, Jin Yan, Zhou Hui, "Design and implement of enterprise knowledge management

system - In case of Zhejiang Electric Power Test and Research Institute", Journal of Software, Vol. 6, No. 8, pp. 1570-1577, 2011

- [15] Jin Cui, Liu Naijia, Qi Li, " Research and application of data archiving based on oracle dual database structure ", Journal of Software, Vol. 7, No.4, pp. 844-848, 2012

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