Design and Implementation of the Oil Depot Training System based on Database

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Abstract—Taking the development of an oil depot training system for instance, the key technologies and development process of the system are described in this paper. Firstly, we begin with the background and significance in the research subject, and then we expound the overall structure and functions of the system and design processes. Secondly, we lay special stress on analyzing the database design, including requirements analysis, structure design and database access design. The ideal combination between Windows Visual Studio 2008 and C# is applied to the realization of development platform and module functions. At last, we use Right Hemisphere Deep Exploration to realize multimedia design and development. As an exploration with practical meaning, the aim of this system is to realize an intelligentized, systematic and interactive oil depot training system to satisfy the needs of efficient and lower cost for managers and trainers, which will promote the informationization and intelligentization of equipment support and will bring us efficiency and direct economic benefits.

Keywords- database; C#; interactive; Deep Exploration

I. INTRODUCTION

For a long time, the training of complex equipment has been being carried out taking the actual circumstances as the backing for most institutions. The operating manuals made of paper are used as teaching material. The problems occur when in actual use. It is inconvenient to find information and is not handy for users to carry, besides, the paper manual updates slowly and vast amounts of data occupy considerable space, which make the training cost keeping prices up. The possible drawbacks of the training method that on-site training of operators are a large investment, a long training period and training effects which can't be guaranteed. Therefore, On the basis of the principles of practicability, safety and economy, we apply the database technology to management and training of complex equipments and facilities taking advantage of its characteristics in data management and information organization [1]. At the same time, we apply Deep Exploration to multimedia presentation taking advantage of its characteristics in knowledge expression and stronger interactivity to realize the friendly and highly interactive training management system of complex equipments and facilities.

II. SYSTEM DESIGN

A. System Functionality Description

The system provides technological support to maintenance support of the facilities in the oil depot in order to ensure management and maintenance staff rapid access to technical information:

1) User Permission Management

When users login the system, they are required to enter a user name and password. General users only can use browse and search function while the administrator can maintain and manage the system to ensure that the system works correctly and stably.

2) Navigation Function

Guided navigation and direct retrieval are both important in the system. That is to say, not only can we retrieve the necessary information details directly, but we can view the information by navigation. The methods of navigation are navigation tree composed of information marked and page link.

3) Search Function

Searching a message in a large navigation tree is so complicated that we design the search function for obtaining information efficiently and conveniently, although the users can search information through navigation tree.

4) Display Function for Different Data

The basic function of the training system is data information display. There are a variety of information data can be represented in the system including text messages, drawings, 3D modeling and animations.

5) Database Management

The administrator can use the functions including user information management, all kinds of information management of equipments and facilities. The system function modules are shown in Fig 1.

Figure 1. The system function modules
B. Analysis and Design of System Framework

The oil depot training system for equipments and facilities is an interactive visualization system which combines the advantages of visualization of equipment information, structured system and interactive design. The process of system development can be divided roughly into three phases: data collection, database design and data use. Data collection, chiefly collection of paper manual, electronic data, engineering drawings which will be converted into a special format the system required. Database design, chiefly requirements analysis, concept structure design and logic structure design. Multimedia data use, chiefly the usage of the multimedia information in the database (including data search and data view) through subscriber terminal equipments [2]. In this way we can see a complete oil depot training system. The system can be used for database queries, information view of the structures, functions, principles, maintenance information of various equipments and facilities, and interactive training. The flowchart of the system design is shown in Fig.2.

Figure 2. The flowchart of the system design

III. DATABASE DESIGN

Access database management system is the important part of Microsoft Office, which is used to store and manage the user data. Access is not only a database, but also has powerful data management capabilities. It can use a variety of data sources to generate forms, queries, reports and application procedures easily. Taking into account the department of depot equipment training system is of medium-small system and the amount of system data is not too large, we use access 2007 database to build the basic information systems of oil depot equipments and facilities.

A. Database Requirements Analysis

The database functions of depot equipment and facilities system mainly embody in the user login, data navigation, the query of various equipments information including work principle, structure drawings of parts, and maintenance and operation introduction. Each part of the data has intrinsic connection. According to the data characteristics of the system, we can summarize the requirements as follows:

- The users who have a membership can login depot training system have access to system features.
- Specific equipment in the depot facilities must have specific location information, that is, all the facilities need to be categorized.
- Specific equipment and facilities information contains its structure, function, principle, maintenance manuals, etc. That is, all the query items of the specific equipment or facility need to be classified into different types.
- Users can easily and quickly browse the depot facility information through friendly interactive interface.

After the system functional analysis and requirements summary, we can design data structures and data items as the following:

- Member information: including membership number, member name, affiliation and other items.
- The classified information of depot equipments and facilities: including the coding of classification and the data item name of classification, etc.
- The information of depot equipments and facilities, including ID, name and classification methods of equipments and facilities, etc.

B. Database Concept Structure Design

Obtaining the data items and data structure, we are able to design the various entities and relationships which can meet the requirements. Then we use ER (Entity-Relationship) diagram to show those relationships which make the basis for the logical structure design [3]. The system has the entities as follows: member information entity, classification information entity of depot equipment and facilities, information entities of depot equipments and facilities. The relationship between them is shown in Fig 3.

C. Database Logic Structure Design

The result of concept structure design is ER model, but it is independent of any other data model, also independent of any specific DBMS. In order to establish the user’s database, the concept model need to be converted into a specific data model supported by DBMS. That is the task of database logical structure design. The oil depot training system consists of eight...
data tables, they are member information tables, classified information tables of depot equipments and facilities, oil tank table, valve table, pump table, send receive set table, electric installation table and fire fighting equipment table [4]. Table I shows the classification information table of depot equipments and facilities. Table II shows the information table of depot equipments and facilities. Member Information table contains three fields just as UserID, UserName and UserDept, UserID as the primary key; classified information tables of depot equipments and facilities includes two fields just as CatID and CatName name, the primary key is CatID; The information of depot equipments and facilities table contains four fields including PartID, PartName, CatID and CatMode classification the four fields and the device number as the primary key.

TABLE I. CLASSIFICATION INFORMATION TABLE OF DEPOT EQUIPMENTS AND FACILITIES

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
<th>Primary Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>CatID</td>
<td>int</td>
<td>✓</td>
</tr>
<tr>
<td>CatName</td>
<td>nvarchar</td>
<td>×</td>
</tr>
</tbody>
</table>

TABLE II. INFORMATION TABLE OF DEPOT EQUIPMENTS AND FACILITIES

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</tr>
<tr>
<td>CatID</td>
<td>int</td>
<td>✓</td>
</tr>
<tr>
<td>CatMode</td>
<td>nvarchar</td>
<td>×</td>
</tr>
</tbody>
</table>

D. Database Access Design

C# with advantages of the simple grammar, object-oriented design, perfect security, great flexibility and compatibility is developed for .NET applications, which basically guarantees the perfect combination of C# and .NET. The system development platform is WindowsVisualStudio2008, so we select C# as Program Languages.

Database access includes three aspects [5]: database connection, to obtain data sets from the database, the database query. The achievement of main methods as shown below:

1) OLEDB Method
   • Function: obtaining the database connection object.

   The implementation steps and the code is as follows:
   
   a) Connection string: string strAccessConn = "Provider=Microsoft.Jet.OLEDB.4.0; Data Source =" + strPath.ToString () + "; User Id = admin; Password =";
   b) Establish a connection: myAccessConn = new OleDbConnection (strAccessConn);
   c) Open database connection: myAccessConn.Open ();
   d) Close database connection: myAccessConn.Open ();

2) Creation and Usage of DataSet
   • Function: get data set from a database table.

   The implementation steps and the code is as follows:
   a) Connection string: DataSet myDS = new DataSet ();

   b) According to SQL statement "SELECT * FROM" add a new table to the database, here make the valve as an example: String strAccessSelect3 = "SELECT * FROM valve table";

   c) Using OleDbDataAdapter to create the object myDataAdapter3: OleDbDataAdapter myDataAdapter3 = new OleDbDataAdapter (strAccessSelect3, myAccessConn);

   d) Using OleDbDataAdapter object myDataAdapter3 to fill the valve table data into myDS: myDataAdapter3.Fill (myDS, "valve table");

3) Related Record Query
   If we want a record in a field, we can use the method as follows:
   myOpt1.NAME = row.Field <string> ("depot equipments and facilities ").ToString ();
   myOpt1.index_in_file = row.Field <int> ("ID");

IV. DESIGN AND CODE IMPLEMENTATION OF THE FUNCTION MODULES

A. Design of Login Module

As is shown in Fig4, we mainly use TextBox control and Button control to realize the Login interface design, which can help the system to get user information and respond to the login operation. The two text boxes are named LNameTbx and psWTbx which can be use to receive the user name as well as a password [6]. The Button named login is used to submit login information. The main code is described below:

   if (reader.Read()) // if the user information is found, it means a successful logon
   {
     MainForm newForm = new MainForm();
     newForm.Show (); // pop up main form
     this.Hide (); // hide login form
     this.DialogResult = DialogResult.OK;
   }

   else
   {
     MessageBox.Show("Invalid Username or Password!");
   }

Figure 4. Login module

B. Design of Query Function

In the system, we can view the information by navigation visually. The list module of the depot equipments and facilities
is realized by the Tree View control, which is of view class and is mainly used to complete display of the navigation tree. The main code is described below:

```csharp
if (trRootNd.Nodes[i].Text == "valve")
{
    …
    foreach (DataRow row in tc.Rows)
        …// different functions query
    TreeNode trNdCls = new TreeNode(myOpt2.NAME);
    trNdCls.Tag = myOpt2;
    trRootNd.Nodes[i].Nodes.Add(trNdCls);  //clear view
}
```

V. MULTIMEDIA DESIGN

In this paper, 3D model control provided by Deep Exploration is applied to the multimedia design of oil depot training system. A Deep Exploration CAD Edition is a model browser for showing 2D, 3D models and it supports 80 kinds of 3D formats. In addition, we can edit and add comments to models of the system and also can produce animation.

The production of interactive 3D for training system involves five steps as follows: build the 3D models→convert the format of the 3D models→add the interactive features and control modules to 3D models and obtain the applicable file formats to system→insert the outputs into the oil depot training system[7].

However, the Deep Exploration has not the function of modeling, we have to choose other 3D software (such as MultiGen Creator, AutoCAD) to build the 3D solid models of facilities and equipment in the oil depot. After that we can develop the demonstration function of component structure and their removal and installation. The system diagram is shown in Fig.5.

![Diagram of the framework of dynamic demonstration system](image)

Figure 5. The framework of dynamic demonstration system

We can add the interactive features and control module to 3D models by Deep Exploration. Through a series of design including interactive animation design, view design and removal and installation design, the users can zoom in, rotate or translate the models by mouse and can also view the internal structure of the components by way of hiding some part of the components by keyboard and mouse. In the interactive 3D environment, the demonstration of dismantlement process of the magnetic valve can be completed by mouse and the demonstration completed will be saved as *.Rh. As is shown in Fig.6, we can see the demonstration in the oil depot facilities training system.

![Demonstration of work principle and dismantlement process of the magnetic valve](image)

Figure 6. Demonstration of work principle and dismantlement process of the magnetic valve

VI. CONCLUSIONS

In the article, we mainly introduce Design and implementation of the oil depot training system based on database. We focus our attentions on the database design which is built by access 2007. In addition, the interactive animation design which is completed by deep exploration is presented in the article. This practical research will promote the informationization and intelligentization of equipment support and will bring us efficiency and direct economic benefits, which has important practical significance.

REFERENCES