

Research on the selection and design of power safety training system database with the combination of virtuality and reality

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Abstract. With the development of virtual reality technology, the power safety training system which is convenient to carry out and reduce power accidents provides a safe training platform for power enterprises. This paper proposed the scheme of electrical safety training system database selection and design based on the combination of virtual and reality, analyzed the selection of database to determine the database management system, and then the database system was block designed, which will solves part of the database design issues for virtual reality training system.

1 Introduction

With the growing size of the grid, power grid accident harm also escalates. The reasons of causing grid accident have many such as weather, equipment failure, malfunction, etc, which account for a large proportion and can be controlled is caused by illegal of staff, even has been threatening the security of the grid for a long time [1]. Power safety rules production training is the effective way to improve power staff safety quality, prevent casualties and ensure the power grid safe and stable operation. Electricity safety training is mainly in the form of site-based training and examination, there are many deficiencies. With the development of virtual reality technology, power safety training system with actual situation makes full use of the power system internal LANs, and provide a virtual interactive safety training platform for the power companies, which is easy and efficient to carry out safety management, safety training of technical staff, improve staff security theoretical level, enhanced safety technology skills, thereby minimizing the occurrence of accidents in their daily work [2].

Database is the core and foundation of information systems, it can manage a lot of data in information systems according to certain rules; provide storage, maintenance, retrieving data and other functions; so that information systems can be convenient, timely and accurate access to the desired information from the database. Therefore, establishing a good organizational structure and database is the key for information management system design. Five types of information must be saved for this database design, that model information, user information, training and assessment information, safety rules and other regulatory information. The effective integration of the five categories of database information and database rational selection and design, greatly improve the efficiency of training managers [3, 4].

2 Database Selection

Due to the large number of employees of power systems, in the use of power safety training systems with actual situation, it is likely to occur that thousands of users simultaneously connected to the system database (concurrent connected) at the same time, especially focused on the time of training and assessment. To solve such problems, in addition to strengthening the management measures, the more we need is selecting the database system that has excellent performance and ease management. Microsoft SQL Server can provide comprehensive protection for these environments with safety measures to prevent the problem. Microsoft SQL Server is a high-performance SQL Server database management system released by Microsoft corporation, can combine with the Windows operating system and be scalable, provides large system required

database service, and support enterprise OLTP (online transaction processing) and large data warehouse systems OLAP (online analytical processing). Its main features are as follows [5, 6]:

- 1, Varieties of data types are supported, symmetric multi-processor architecture.
- 2, Windows graphical local and remote database maintenance and settings.
- 3, Good safety performance, users can reduce development costs.
- 4, Prevents multiple users simultaneously update the same data.
- 5, Cluster management, data processing load distribution to multiple servers.
- 6, using standard SQL Structured Query Language.

In view that the above features of Microsoft SQL Server database management system can meet the requirements of power safety virtual interactive training system, this paper uses SQL Server database as its database server. Microsoft SQL Server database records with the actual situation with scenes and user information. Following figure described the relationship shown in the data flow between the students, teachers and system administrators with the entire system of training [7].

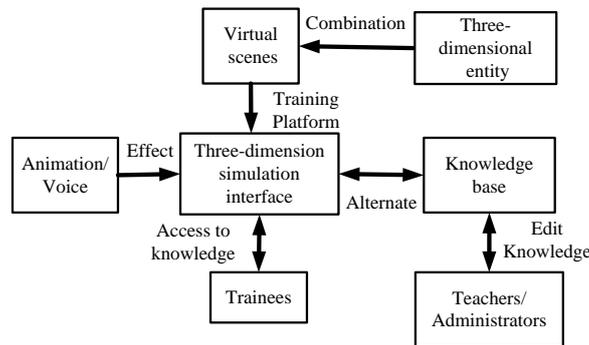


Fig. 1 Data flow of training system with virtual and reality

3 Database Design

3.1 Database table design

When designing database tables of power safety training system database with the combination of virtual and reality, should take into account more data items, data volume and other characteristics in addition to the needs of combining, this paper applied database structure design principles of the relational model. The data of this training system includes model libraries, simulation operation database and information database. Since simulation operation database and information database has large storage capacity, complex structure, therefore, the database design focus on the design of simulation operation database, information database. The design of the simulation operation database is to use object-oriented design thinking, according to the actual situation of the power of the virtual environment, the initial corresponding tables for the each step of power virtual scene were created, the corresponding steps were correspond to a database table. Table 1 and 2 are the database tables related to power safety operation for replacing defective insulators under 10kV distribution network and in the Microsoft SQL Server.

Table 1 Trainees information database table

Field name	Data Types	Length	Null	Primary key	Remark
xy_ID	varchar	20	No	Yes	Student ID number
xy_Loginname	varchar	50	No	No	Student Name
xy_Password	varchar	50	No	No	Students Password
xy_IDcard	varchar	50	No	No	ID number
xy_Type	varchar	50	Yes	No	User Properties
xy_Work	varchar	200	Yes	No	Trades
xy_Registertime	varchar	50	Yes	No	Registration time

Table 2 Trainees simulate operating table

Field name	Data Types	Length	Null	Primary key	Remark
cz_Num	varchar	50	No	Yes	Operation No.
cz_Operatename	varchar	500	Yes	No	Operation name
cz_Realtime	varchar	200	Yes	No	actual operating time
h	varchar	50	Yes	No	Reverse number
cz_Warningtime	varchar	50	Yes	No	Warning number
cz_Lx	varchar	50	Yes	No	Omissions

3.2 Database connection

The engine itself does not support SQL Server database connection, but can change the engine to achieve support. Since Torque is based on the Win32 platform, so this paper chose the method of Win32 connection to the database when the engine changes, compiled on the engine again after this feature is added to engine source code, obtained the script file, specified the database type, connection address, table name, the user names, passwords, etc., you can connect to the database and read, modify, add or delete SQL Server database. Chose the Torque connections to SQL Server database as an example to analyze the connection process, Torque connect SQL Server database engine has the following two steps:

1) to establish a connection object with the DatabaseConnection (), as follows:

```
$ db = new DatabaseConnection ( );
```

2) construct SQL statements, use ConnectDriver (parameter 1, parameter 2) connect to the database, as follows:

```
% rv = $ db.ConnectDriver ($ Pref :: Server :: DB :: Driver, % connectionString); wherein, ConnectDriver ( ) parameter 1 is database driven, parameter 2 is connection string.
```

3.3 Data Security Design

For any kind of systems security are very important, there is a potential threat without insurance for its future work. In the design of specific system security, it is possible adopt appropriate safety measures according to the system's hardware and software design features, such as firewall technology, user authentication, data encryption, the following is detailed description.

1) MD5 encryption. The full name of MD5 is message-digest algorithm 5 (Information - digest algorithm), developed in the early 1990s, after md2, md3 and md4 evolved. Its role is to make large-capacity information to be "compressed" into a confidential format before signing the private key with a digital signature software, that is to say, convert an arbitrary length byte serial into a certain length of large integers. Whether a background management system or a mobile terminal have carried out MD5 encryption to ensure data security in this system is.

2) stored procedure in SQL Server, important data of database queries and other operations are in Sever internally, so that security has been strengthened.

3.4 Data Integrity Design

The integrity of the data involved the quality of data, including its accuracy and reliability, although Microsoft SOL Server databases makes constraints on type, precision, and range of data, but only the integrity of the database system is not able to meet the system requirements about data accuracy and reliability, and in the process of implementation, the program design using the following methods for data integrity constraints:

1) In the system user interface, try to provide the form of choose for system operations using extensive code tables, thus reduce the arbitrariness of human input, convenient follow-up maintenance of system, and enhance the accuracy of the operation.

2) date, time, etc. usually used in the user interface are in the form of a calendar or time selection controls to ensure consistent format input [8].

4 Conclusion

This paper describes the selection and design of a power security training system database. Combining the advantages of Microsoft SQL Server database management, this paper choose Microsoft SQL Server database management system as the database server of power safety training

system with the combination of virtual and reality. Analyzed the database system design from several angles, designed the corresponding database tables for each operation of power virtual scene using object-oriented design ideas, changed the engine to solve the connection problems between the virtual engine and database. And used the local database and MD5 encryption to ensure data security of the system and effectively ensure data integrity. This article provided the selection and design of a database based on the establishment of power safety training system with the combination of virtual and reality to ensure efficient data transmission, security and integrity, has some practical value.

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