Online Training System of Distribution Network Equipment Operation and Maintenance Security Based on Cloud Model

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Abstract. Electricity demand is more and more big, the distribution of power distribution network equipment is becoming more and more complex, and the need for operational safety training, and the safety of the traditional functions of the system of online training modules are not comprehensive, unable to meet the demand of the current operational safety training, so based on cloud model to design new equipment operational safety online training system, the hardware part of the design of the ARM processor and FPGA chip, In the software part, the online training module of operation and maintenance safety is established, the online training database is designed based on the cloud model, and the online training of distribution network equipment operation and maintenance safety is realized, and the system test is carried out. The results show that the designed online training system of distribution network equipment operation and maintenance safety has good performance and certain application value.

Keywords: Cloud model · Distribution network · Equipment · Operation and maintenance safety · Online training system

1 Introduction

With the development of computer technology, computer has become a medium of auxiliary teaching, and computer-aided teaching has emerged. It can assist teachers to arrange teaching, manage or achieve individualized teaching [1], especially in imitating the actual situation and expanding the teaching level. In order to ensure the safe operation of power system, in addition to reliable equipment, reasonable power grid structure [2], scientific management mechanism, we must also strive to improve the operation skills of power employees. Due to the high-risk industry characteristics and special working environment of power grid, the traditional training methods can not meet the needs of power safety training. It has become a beneficial choice to apply virtual reality technology to build power virtual environment for operation skill training.

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For the power industry [3], due to the unpredictability of power accidents, there is a lack of experience in dealing with emergency accidents. Another way is a single book safety knowledge training, which is often one-way filling training and education. The active participation of employees is seriously insufficient, resulting in poor training effect. The third way is on-site training, which is a more effective training method. However, this method often requires a lot of funds and corresponding teacher investment. At the same time, due to the irrecoverability of power personal casualty accidents and personnel liability accidents [4], the on-site training can not fully simulate the wrong use of tools, possible dangerous points and possible safety accidents in actual production, and can not achieve a good training effect; In addition, in the process of technical competition assessment, it will also need to spend a lot of human, material and financial resources to prepare the work site and mechanical equipment. It is also restricted by weather and time, which is not convenient for regular development.

Due to the high-risk industry characteristics and special working environment of power grid, the traditional training methods can not meet the needs of power safety training. It has become a beneficial choice to apply virtual reality technology to build power virtual environment for operation skill training. Therefore, this paper designs an online training system for distribution network equipment operation and maintenance safety based on cloud model, To solve the current training problems. In the hardware part, ARM processor and FPGA storage chip are designed, in the software part, the online training function module of operation and maintenance security is established, and the online training database is designed based on the cloud model to realize the online training of operation and maintenance security of distribution network equipment. The training and teaching of power safety regulations are assisted by computers to help learners learn, so as to replace the above-mentioned methods of conversational guidance, simulation exercises, situational learning, etc. [5–7]. The virtual simulation system of electric power safety regulations can provide learners with a more real environment, which is mainly to improve learners' learning effectiveness, save teaching costs and improve teaching effectiveness. The simulation system learning of virtual reality technology not only assists the traditional vocational teaching, but also allows learners to contact simulation scenes anytime and anywhere. It also allows professional teachers and learners to have two-way communication opportunities and participate in discussions, so that learners have multiple choices of learning methods [8]. In addition, some security simulation systems further build virtual classrooms or laboratories, and use computer simulation to simulate the teaching materials and equipment in the laboratory [9], so that professional teachers and learners can learn, train and even test through an interactive virtual environment. Computer virtual vocational training has become the trend of power safety education in the future. In order to ensure the safe operation of power system, in addition to reliable equipment, reasonable power grid structure and scientific management mechanism, efforts must be made to improve the operation skills of power employees. The research shows that the designed system has good performance.

2 Hardware Design

2.1 ARM Processor

In order to ensure the training effect of the operation and maintenance safety online training system and improve the processing speed of the system, the designed system uses ARM processor. ARM microprocessor is a 32-bit RISC processor with low power consumption and high performance. The core of ARM processor is unified and provided by arm company, while the on-chip components are diverse and designed by major semiconductor companies, which makes it possible to use different on-chip designs based on the same core when using arm to design embedded systems [10], which has great advantages. ARM processor supports seven operation modes, which can be roughly divided into user mode and privilege mode. It has 37 32-bit registers, of which 31 are general registers and 6 are special registers. Arm architecture supports storing word data in big end mode and small end mode. In big end mode, the high address of word data is stored in the low address, and in small end mode, the low address of word data is stored in the low address.

At present, ARM processor cores can be divided into several series, such as ARM7, ARM9, arm9e, arm10e, ARM11, securcore, strong arm, X scale, etc. ARM7, ARM9, arm9e and arm10e are several mainstream series of ARM processor series. These four processor series provide specific solutions for specific embedded system requirements from different application performance. ARM7 series adopts three-stage pipeline. Arm7tmdi has low power consumption and relatively high performance. It is widely used in consumer electronic products that are sensitive to cost performance.

ARM9 series adopts 5-level pipelining and Harvard structure, supports full-performance MMU, and provides the best performance in terms of high performance and low power consumption. Arm9e series adopts 5-stage pipeline and supports DSP instruction set, which is suitable for occasions requiring high-speed digital signal processing. Securcore series is specially designed for applications with high security requirements. Strong arm/X scale is the arm core provided by Intel. ARM11 core focuses on the improvement of data processing ability, and implements a multiprocessor core in arm for the first time. Cortex is the latest ARM core. Based on armv7 architecture, it is a new product series, which is divided into three series: a (application field), R (real-time field) and m (control field). It improves the specific core for the high, medium and low-end needs. Therefore, this paper uses ARM9 as the microprocessor of the design system.

2.2 FPGA Storage Chip

Compared with ASIC, FPGA has many excellent characteristics. However, the excellent characteristics of FPGA are at the expense of the performance of the chip. In order to realize the programmable characteristics, a large number of programmable switches are used in FPGA chip. These programmable switches have greater connection capacitance and resistance than wires, which reduces the speed, increases the circuit area, and has greater power consumption. For circuits of the same scale, the average area required by FPGA is about 40 times that of ASIC, the power consumption is about 12 times, and the average speed decreases by about 3.2 times L5. Therefore, in order to better meet

the needs of the market, FPGA is bound to develop in the direction of high density, high speed and low power consumption. In recent years, with the continuous progress of chip manufacturing technology, the gap between FPGA and ASIC in speed and area is narrowing. In 2010, Xilinx company launched artix-7 series FPGA products. The power consumption and performance of this series of products are greatly improved compared with the previous generation products. In addition to adopting 28 nm process, the unified architecture and scalable platform of this series of devices further simplify the system design. Compared with the previous generation spartan-6 series devices, its speed is increased by 30% and its size is reduced by 50%, And prices have fallen by 35% 6. With the further development of chip manufacturing technology, the gap between FPGA and ASIC in speed and area is still narrowing. However, with the increase of FPGA speed and smaller size, the power consumption of the chip is becoming more and more prominent.

An FPGA device is actually a programmable logic unit array, and different logic units are connected through programmable wiring resources. The logic unit array is used to realize the logic functions of the circuit. Due to the limited functions that can be realized by each logic unit, wiring resources need to be used to connect the logic units to form a large system. The basic architecture of FPGA device is shown in Fig. 1.

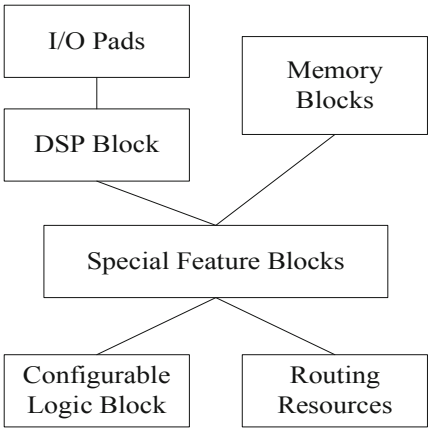

Fig. 1. Basic architecture of FPGA device

As can be seen from Fig. 1, FPGA chip is mainly composed of programmable logic block, wiring resources and programmable input/output module. The programmable logic block is surrounded by prefabricated wiring resource channels, and the FPGA is surrounded by programmable input/output modules. In addition, modern FPGA devices also include embedded bottom functional units, embedded special hardware modules, block ram, clock management module and other resources.

Programmable logic module, also known as configurable logic unit, is the basis for FPGA to realize various logic functions. Users can determine the function of each logic function unit and their interconnection relationship through programming, so as to realize the logic circuits with different functions. In the programmable logic block, the look-up table technology is used to realize the basic logic function.

The routing resources of FPGA devices are composed of programmable routing resources and global routing resources. Programmable wiring resources are one of the most important resources in FPGA. Programmable wiring resources connect each programmable logic block or input/output block to form a circuit with specific functions. Global wiring resources are used to realize global signals such as clock and reset of devices.

Programmable I/O module is the interface between the chip and the outside world, which completes the interconnection between internal logic and external pins, and provides functions such as input buffer, output drive, interface level conversion, impedance matching and delay control. The programmable I/O module has the characteristics of low power consumption and high-speed connection. In order to make FPGA devices have the ability of joint design of software and hardware, realizing the same single-chip FPGA has become a system level design tool. Modern mainstream FPGA devices will provide many embedded bottom functional units, such as DSP, CPU, digital clock PLL, PLL and other software processing cores. With these embedded bottom functional units, FPGA devices can easily transition to SoC platform.

In order to improve the performance of FPGA, FPGA manufacturers have integrated some special hard cores in the chip. These hard cores are equivalent to ASIC circuits and have strong processing power. For example, Xilinx's high-end FPGA products not only integrate PowerPC Series CPU, but also embed DSP core module. In addition, in order to improve the multiplication speed of FPGA, special multipliers are integrated in mainstream FPGA.

Modern FPGAs have a large number of configurable block ram. Block RAM can be configured into FIFO memory, single port RAM, real dual port RAM, pseudo dual port RAM (or simple dual port RAM) and content address memory (CAM), which greatly expands the application scope and design flexibility of FPGA. A large number of block ram provides very high memory access bandwidth for the logic in FPGA. Parallel memory access can greatly improve the performance of applications. Most FPGAs in the industry provide digital clock management. For example, Xilinx introduced the most advanced FPGA to provide digital clock management and phase loop locking. Phase loop locking can provide accurate clock synthesis, reduce jitter and realize filtering function.

3 Software Design

3.1 Establish Operation and Maintenance Safety Online Training Function Module

In the final analysis, the security of power system is determined by the reliability of system equipment and the quality of production personnel. After the hardware facilities are determined, the technology, experience, proficiency and adaptability of production personnel are one of the important factors affecting the safe operation of power system. The virtual interactive training system of power safety regulations based on virtual reality technology is to develop a power virtual interactive training environment covering the combination of theoretical knowledge and practical safe operation skills of multiple disciplines such as power grid operation and maintenance according to the training needs of different trainees. Through these trainings, trainees can master the basic skills

of operation, maintenance and overhaul of power equipment faster and better, so as to avoid power safety accidents due to wrong operation to the greatest extent. The main content of theoretical knowledge training is the basic knowledge of electrical appliances and operation necessary for safety production personnel of power plant or power grid, that is, the (substation and line) of safety regulations. Multimedia methods such as pictures and words are used to explain, so as to make full use of this method to mobilize human senses and thinking imagination, deepen students' understanding of the contents of power safety regulations, and improve students' theoretical knowledge level, so as to avoid safety accidents in practical operation.

It is mainly to realize the training on the working principle of power equipment (such as line, substation, transformer, etc.) and its related electrical connection relationship. In order to explain the power grid structure and the working principle of its equipment, the domestic leading three-dimensional virtual reality technology is used to simulate the power grid and geographical environment, which is presented in an interesting high realistic three-dimensional picture to give the trainees an immersive feeling. When the system is in the learning (training) mode and students practice themselves, if the students' operation does not comply with the operation rules or the sequence of operation steps is wrong, the system interface will give students an alarm prompt. For example, the power must be checked before installing the grounding wire. If the student does not check the power, the system interface will pop up a prompt "you forgot to check the power!" At the same time, the student cannot proceed to the next step. The training management system collects and classifies relevant information such as trainees' type of work and educational level, and formulates personalized training plans for different trainees. Training evaluation automatically tracks the completion of operation steps of each training content, records the training process of trainees, and automatically evaluates the operation results of trainees; The evaluation system forms an evaluation report according to the student information, training content, historical records, etc.

This system fully draws lessons from the development mode and technology of 3D game. On the one hand, it creates an immersive feeling for the students in a realistic display mode, so that the students can get the effect similar to the on-site operation. For example, in the modeling of power construction process, in addition to simulating relevant power equipment, it is also necessary to simulate natural phenomena such as rain and snow and sparks splashing during electric shock, and provide sound to relevant places. At the same time, when simulating power operation, it is often designed according to the idea of three-dimensional dynamics, so as to well simulate the actions of power tools and equipment in the system, such as free fall, rolling, tilting and so on. It makes the whole training scene vivid and gives people a feeling very similar to the simulated objective world, just like in the real world. On the other hand, human-computer interaction operation mode and integral system are adopted. In the virtual environment, the operator pushes the plot forward through independent selection. If the operation is wrong, the corresponding points will be deducted, so as to give full play to the students' initiative. Through this game training method, improve the fun of power workers in the training process, change the traditional rigid training mode, and realize the transformation of students from "want me to train" to "I want to train".

Cloud model is not only the specific implementation method of cloud, but also the basis of cloud based computing, reasoning and control. It can represent the process from qualitative concept to quantitative representation (forward cloud generator) or the process from quantitative representation to qualitative concept (reverse cloud generator). In essence, cloud model is an advanced computer user interface; In terms of application, it is the latest technology in the computer field, which is comprehensively developed by a variety of science and technology such as computer graphics technology, multimedia technology, human-computer interaction technology, network technology, stereo display technology and simulation technology. It is also the comprehensive application of various disciplines such as mechanics, mathematics, optics and mechanical kinematics. The system "moves" the actual power environment to the computer and provides users with various intuitive and natural real-time perceptual interactions such as vision, hearing, touch and so on. So that students can complete the training of various operation processes with the help of computer, keyboard and mouse without any danger, and carry out operation and theoretical assessment, multi-level learning and examination. By providing users with a virtual scene close to or better than the real environment, dangerous accidents are effectively avoided. However, in the process of distribution network equipment operation and maintenance, it is very easy for trainers to be tired, resulting in training error. The error expression is as follows:

$$N_s = \sqrt{\frac{\pi}{2}} \times \frac{1}{s} \tag{1}$$

In formula (1), N_s represents online training error and s represents online training information. In this paper, the cloud model is used to eliminate the online training error, and the formula is as follows:

$$K_m = \sqrt{X^2 - N_s^2} \tag{2}$$

In formula (2), K_m represents the online training situation after error elimination; X^2 represents distribution network operation and maintenance standard information.After eliminating the error, analyze the person in charge of online training. The training leader is the most important role in the whole training system except the system administrator. He is mainly responsible for training module management, training plan formulation, training result report generation and other affairs. Among them, the content management of training module not only needs to import relevant training content, but also needs to regularly upgrade, delete and add the expired content in the training system, so as to ensure that the training received by employees is up-to-date. For the training plan making part, because it is for the employees of the whole company, and the employees will be more or less different due to different foundations or positions. Therefore, in the training plan making part, different training plans need to be set according to different user types. In addition, for the overall training results after employee training, the training leader also needs to be able to regularly view the statistical results, so as to know the actual training situation, so as to make timely feedback and adjustment.

3.2 Design Online Training Database Based on Cloud Model

Database is the core and foundation of information system. It can organize a large amount of data in information system according to certain rules; Provide the function of storing, maintaining and retrieving data; So that the information system can conveniently, timely and accurately obtain the required information from the database. Therefore, establishing a good data organization structure and database is the key to the design of information management system. The system database must store five types of information, namely model information, user information, training and assessment information, safety regulations and other regulatory information. Related model information table: stores the description information of related models and the drawing information in the virtual scene, such as the model category, name, number, three-dimensional coordinates, size and corresponding 3D model file name of the virtual power equipment. User information table: used to store personal information of system administrators, instructors and trainees. Training and assessment information table: used to store the assessment information of system students, such as theoretical examination, simulation operation, assessment system and scoring standard. Power safety regulation knowledge table: used to store safety regulations and other power regulation information. This paper integrates the relevant information to obtain a unified database table, as shown in Table 1.

Table 1. Database table

Field name	Explain	Type	Is it empty
Ma_ID	Name	Varchar	Yes
Ma_name	Full name	Varchar	No
Ma_Num	Number	Invarchar	No
Ma_Time	Time	Varchar	No
Ma_Type	Type	Char	No
Ma_Work	Type of work	Varchar	No

As shown in Table 1, the virtual interactive training system of power safety regulations is based on the internal LAN of the power system. Therefore, in the process of use, if there are accidents such as network disconnection, data loss will be caused. This not only brings inconvenience to users, but also leads to unfair assessment due to data loss in the process of training and assessment. On the other hand, in order to reduce the network burden. This topic adds Microsoft's access database to the client, so that the client can save the data to the local encrypted database first, and transmit the data to the server at a breakpoint. When the service ends normally, the client will automatically empty the local database.

The training and examination of safety regulations is a long-term and uninterrupted task. The safety regulation network examination module embedded in the system can realize the processing of batch or single knowledge points, automatic and manual volume forming, online monitoring, computer automatic marking and Score statistical analysis,

which greatly improves the work efficiency of training managers and can overcome the injustice of traditional training in the process of examination organization and implementation. Perfect evaluation system to achieve good evaluation effect. The application of virtual reality technology in power safety regulation virtual interactive training system has great advantages in operational knowledge evaluation and design compared with the traditional safety regulation training system. Because virtual reality technology can simulate the whole standardized operation process of power safety regulations and the corresponding hardware environment, not only questions (multiple-choice questions, blank filling questions, short answer questions, etc.), but also students can achieve good assessment results without the interference of time, region, environment or others.

3.3 Realize Online Training on Operation and Maintenance Safety of Distribution Network Equipment

At present, cloud model has been widely valued, discussed and studied by the public, but it still focuses on academic units. Generally, the definition of virtual simulation is numerous. Views on cloud model definition: the first is that cloud model is the content that objects, attributes and relationships are adjusted into natural similarity or surface reality. Cloud model is a high-dimensional space generated by computers, including an environment that can enable participants to effectively recognize. The third view holds that the cloud model is a combination of sensing, feeling and thought. The computer changes the experience and emotion of the input through controlling the feeling. The cloud model has the following advantages. First, creativity: it can solve problems by using cloud model applications with different properties for different problems. Second, integration: the user's senses produce the feeling of integrating into the virtual world and become a part of the virtual environment. Third, interaction: users can operate, change and interact with objects in the virtual world, just like the real world. Basic classification of computer virtual simulation technology. Due to the different requirements of virtual simulation technology for input and output equipment and the types of visual perception, it is generally divided into the following four categories, as shown in Fig. 2:

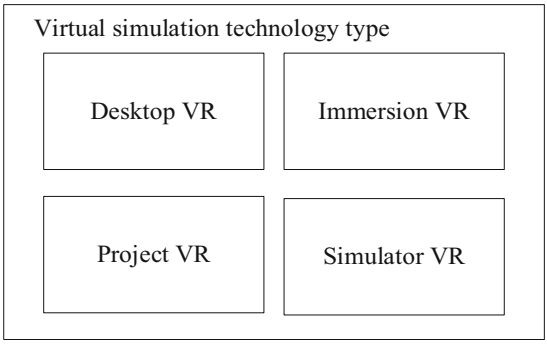

Fig. 2. Structure diagram of virtual simulation technology type

The specific contents of the virtual simulation technology type structure are as follows:

First, desktop VR, desktop cloud model system, is a display system of personal computer architecture that users can afford. This system can allow individual users to integrate themselves into the virtual environment. Such a cost-effective system enables users to experience three-dimensional images through image, sound and real-time interaction. Users can place themselves in the desktop cloud model system through the guidance of the simulation program and the manipulation of the mouse or training rod. Its advantages are: the interaction of virtual objects can be controlled by the mouse, and the price of the system is low. The established virtual control platform system is the desktop cloud model system.

Second, immersion VR, an integrated cloud model system, is a low-cost, professional and personal computer architecture cloud model system. This system allows independent users to completely immerse themselves in the virtual environment through three-dimensional images containing video, audio and action. Users can roam in the virtual environment through the actions of hands and heads. Its advantages are: through the action of head and hand, it can fully interact with the virtual scene, so as to have a real feeling and experience.

Third, in project VR, vision is generated by several projector devices around the user, and the whole virtual scene is projected around the user by polarizer to produce a three-dimensional feeling. This cloud model system is suitable for large-scale space and multi person viewing, so it is mostly used in large-scale conferences, exhibitions and entertainment.

Fourth, simulator VR is the earliest developed cloud model system. It uses a special simulator to simulate special situations, which is mostly used in driving and flight training. Basically, the cloud model system is a new interface that integrates drawing, sound, image, animation and related peripherals to achieve communication and interaction between adults and machines. Cloud model provides a new three-dimensional visual, auditory and interactive man-machine interface. In recent years, due to the rapid development of computer software and hardware, the realistic situation of computer animation simulation generated by cloud model can be confused.

The system consists of user, user group management and authority module, training content and training plan management module, employee training, examination module, virtual interactive display module, tutor system module and off-line rendering of power knowledge point scene. The following points are mainly considered in the system design, which are listed as follows: simulation training is the focus of the implementation of the system. Its implementation is completed by off-line rendering of the scene, and the display and interaction parts are completed by flash action script. Flash in the presentation layer interacts with the background in the way of web service. At the same time, the examination module also exchanges data with the background in the way of web service, so as to realize the SOA architecture in a complete sense. Flash is used as the foreground display layer and interaction layer. Since Adobe has compatible browser controls on major browsers, the final display style of each platform can be unified. In addition, because flash is a technology that has been tested by history and adopted by a large number of projects, it has achieved good results. Therefore, both interaction and

efficiency can well meet the requirements of this system design. The whole platform is built with SSH architecture, combined with the use of web service to build a loosely coupled system architecture.

Combined with the display mode of JSP and flash, it realizes a series of comprehensive management of system user information, authority, simulation, assessment and so on. The off-line rendering of the scene used in the system adopts the 3D physical engine technology commonly used in 3D training and development, and fully considers the physical attributes such as gravity and collision. At the same time, the system strives to truly reflect the actual physical attributes of power equipment. With reference to the power facility dynamics physical engine technology, the authenticity of system simulation is greatly improved, It provides comprehensive support for the physical layer simulation of various models for the system. The use of artificial intelligence technology in the selection function of user question bank greatly improves the pertinence of user questionnaires and training projects, provides a complete intelligent learning system for each employee, and greatly improves the learning effect and training efficiency of employees.

4 System Test

In order to test the training effect of the designed online training system, a test platform is built and the system is tested, as shown in the following contents.

4.1 Test Preparation

In view of user simulation, the system will display the pre generated 3D videos and scenes in the form of Flash. At the same time, Action Script will be used to respond to the user's mouse clicks. By judging the way of mouse placement, the mouse will be clicked into an object, and then the relevant events of the object will be invoked to feedback the user's operation. The system test simulation diagram at this time is shown in Fig. 3.

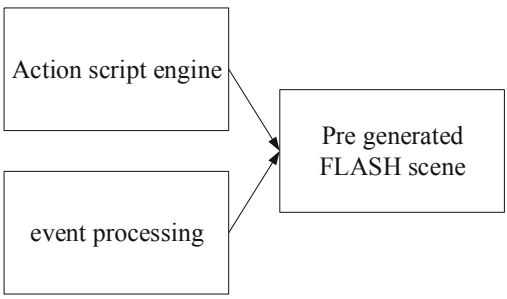

Fig. 3. Test simulation diagram

It can be seen from Fig. 3 that in the system home page, click the "enter" button, and the system displays the following login input box. There are three function buttons

"login" and "exit" in the login part. The login button can be used by administrators and ordinary users, and the exit button can help users return to the system home page. Due to the limitation of software and hardware in the actual test environment, the test environment of the system continues to use the software and hardware in the development environment, and uses the development platform for relevant tests. The built test environment is shown in Table 2.

Table 2. Test environment

Hardware	Configuration
Processor	Intel I7
Memory	8G
Network card	10/100M adaptive Ethernet card
Hard disk	SATA 500G
Test tool 1	Apache JMeter
Test tool 2	Rational robot

Relevant test tools can be selected according to the test environment in Table 2. In order to make the whole system run normally in the production environment and ensure the error free and efficient operation of all realized functions, in addition, to ensure that all business requirements in the original requirements are realized, it is particularly necessary to test the system strictly, scientifically and comprehensively, For the design and implementation of the system, the objectives of the system test phase in the system implementation are defined as follows: ensure that 100% of the original business requirements are covered this time; All unit test cases pass 100%; Ensure that the code test coverage reaches more than 90%; No major defects in the system integration test stage; Ensure that the performance of the system program meets the original design standards.

Because the system in this paper is relatively large, with many modules and a large amount of code, in order to ensure the normal operation of the system, and to ensure that the system can fully execute the whole logic according to the pre design, especially the normal operation of each function block, to ensure that the function block can produce the expected output results for the input, and to ensure the overall correctness of the whole system from the basic module level, it is necessary to unit test the overall code of the system, Ensure that the system can achieve the predetermined objectives in the best way.

4.2 Test Results and Discussion

According to the above test environment, test the performance of the distribution network equipment operation and maintenance security online training system based on cloud model designed in this paper. The test results are shown in Table 3.

Table 3. System test results

Module name	Number of use cases	Number of executions	Code coverage (%)
Permission system	12	12	95
User management	18	18	99
User training	7	7	95
User test	13	13	94
Training content management	14	14	94
Content management of examination question bank	12	12	93
Report form	10	10	92

It can be seen from Table 3 that the code coverage of the design system is high, which proves that the performance of the design system is good, and it can realize efficient online training and has certain application value. The reason is that in the design process of the system in this paper, the establishment of operation and maintenance security online training function module, and then based on the cloud model design online training database, to a certain extent, is conducive to improving code coverage.

5 Conclusion

The purpose of this study is to establish a platform system suitable for the training of electric power industry. For a long time due to the worker within the power company, the job is busy, less time to participate in safety training, training materials of old, makes the mass's enthusiasm is not high, which leads to safety accidents and accidents frequently, only well-trained professionals, in order to better service for the development of electric power enterprises, this platform through relevant literature review, The theories put forward by various scholars for the establishment of safety discipline training simulation system are summarized, and the key links and practical requirements of domestic power safety training are discussed. By referring to some simulation system platforms that have been successfully run at home and abroad, the system that meets the needs of power company safety training is planned. The innovation of the research content is the establishment of operation and maintenance safety online training function module, and the design of online training database based on the cloud model. It is expected that the design and implementation results of this research can serve as a reference for the decision-making of upgrading the power system safety training in the future, so as to improve the quality and effectiveness of the power industry safety training.

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