Design and Implementation of Visualized Substation Inspection Training System Based on Immersive Computer VR

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Abstract. Immersive virtual reality is to provide participants with a completely immersive experience, which allows users to have a feeling of being in a virtual world. Substation equipment due to long running conditions, so in order to ensure the safe and stable operation of electrical equipment, in practice often require the operators to make regular or irregular patrol inspection was carried out on the field devices or use red line temperature measurement method to monitor the running status of equipment. Visualized substation inspection training system can make staff have a very convenient and scientific work platform when carrying out equipment inspection, so as to improve the quality of equipment inspection work. In this paper, from the analysis of substation inspection work and the establishment of inspection system as a starting point, to the application of visual substation inspection training system for the purpose of comprehensive analysis of visual substation inspection training system in the daily work of the advantages.

Keywords: Substation Inspection, Visual Substation Inspection Training System

1. The meaning of immersive VR
Immersive virtual reality refers to a fully immersive experience that provides participants with a sense of being in a virtual world. Immersive virtual reality has many obvious features. When using it, users can use the display inside the helmet to close their vision and hearing, so that users can enjoy virtual visual experience in the helmet. It can use the data system in the hand to allow the user to close the touch channel of the hand when using, so as to generate virtual touch sensation. The system can make use of the voice recognizer to enable the user to give commands to the host system [1]. At the same time, combined with the sensor in the head, the system can achieve real-time analog feedback.

2. Substation inspection system
Substation equipment due to long running conditions, so in order to ensure the safe and stable operation of electrical equipment, in practice often require the operators to make regular or irregular patrol inspection was carried out on the field devices or use red line temperature measurement method to monitor the running status of equipment. However, with the continuous advance of the construction
of unmanned duty and the establishment of monitoring center and operation team, improving the quality and work efficiency of staff patrol inspection has become a problem to be solved.

The stable operation of power system is related to people's life and production activities and even the stability of the country and society. Every failure of the power system is likely to cause incalculable losses to society. Therefore, to ensure the safe operation of the power system is the primary task of the power industry such as the power operation management department [2,3]. The inspection and inspection of electric power equipment is a basic work to ensure the safe and stable operation of electric power system. Traditional staff in the standardized operation of equipment inspection, there are mainly the following hidden dangers:

Arbitrariness is larger, the inspection is not in place, a mere formality, the inspection quality is not guaranteed. As for management, in addition to the relevant regulations and regulations, the work of patrol inspection is basically in an uncontrollable state. (Figure 1)

Figure 1. Hidden dangers existing in traditional patrol work

After the inspection is in place, there is no technical means to control the integrity and accuracy of the inspection items, so the inspection loopholes often appear. In the inspection operation, the staff need to carry a large number of paper operation instructions and record forms, which is not convenient for the development of on-site inspection work, nor can the inspection be carried out on time, so there is the situation of supplementary information afterwards.

When conducting inspection, staff need to manually complete inspection records on site, which leads to a waste of inspection time and irregular filling contents due to time, which seriously affects the efficiency of equipment inspection work.

The preservation, inquiry, statistics and analysis of the inspection history records are difficult, the labor intensity is large, the work efficiency is not high [4]. The manager can not timely understand the field inspection results and equipment defect status.

To sum up, substation equipment inspection work urgently needs a kind of intelligent and visual inspection management system, so as to ensure that the staff can effectively complete the task when carrying out daily inspection work.

3. Visualized substation inspection training system

In view of the above problems, we put forward a visual real-time monitoring equipment inspection system based on the inspection terminal system and radio frequency identification system [5]. This system can let the staff in the equipment inspection work when there is a very convenient and scientific work platform, so as to improve the quality of equipment inspection work. The system can timely record and analyze some problems existing in the equipment, and timely feedback to the staff in the form of reports. And the system has intelligent recognition, in daily work is not only able to
record the problem of feedback equipment, also can carry on the induction analysis to equipment problems, provide solutions to inductive analysis of the problem, so that the simulated training new staff to training, let the new staff quickly master the daily work of the inspection of the equipment and daily work of some of the problems encountered and handled in a timely manner.

3.1. System principle

Visualized inspection management system refers to the standardized inspection operation in a card mode into the inspection device, so as to replace the traditional paper operation instructions for on-site equipment inspection of the operating system. By installing the position recognizer in some key points of the inspection path, the card reader on the hand-held inspection device is controlled by the relevant program to read the coded information on the induction card in order, so as to ensure that the inspection personnel can carry out the inspection operation strictly according to the inspection route planning diagram.

By using the network established inside the substation and the real-time information return function of the hand-held patrol device by the outside inspection staff, the task points of the inspection can be tracked in real time by using the video monitoring function, thus realizing the visual management mode. System terminals provide staff inspection task point specific inspection standard, inspection personnel in the inspection work can be based on the system to provide the standard to inspection task points, and timely upload inspection work results in real time to handheld checking device, by holding a checking device back to the system so as to realize the real-time performance of inspection work [6-8]. This solves the problem that the staff need to record a large amount of data during the inspection work, and after the work needs to process the data feedback analysis. The operation of this system is very simple and practical, which can not only solve some practical problems encountered by the staff in the inspection work but also improve the efficiency of the inspection work to ensure the quality of the inspection work.

Such a system can achieve the following functions:

Setup of patrol task points

First of all, after the overall analysis of the equipment, the system makes statistical editing of the points that need to be inspected, and arranges the points that need to be inspected in the form of tasks, so that the staff only need to complete each task point and position.

The performance of the task

After inspection of the inspection task point, the inspection staff needs to make a summary report on the specific situation of the task point, and this report will be edited in the form of task completion. [9]. The specific situation of each task point will be edited and described on the handheld inspection device, and the situation of the task point will be fed back.
Management of system standard library
After the specific situation of each task point is edited and fed back by the staff, the system will compare the feedback information with the standard information to analyze whether each task point is in normal operation, and record and feedback the abnormal task point.

Inspection data management
Inspection work is a huge and complicated process, the staff need to standardized task point are compared, the equipment status quo of information uploaded to the system, on the basis of the existing data information system for a comparative analysis of the task of providing feedback report, make managers decide whether or not to task for maintenance work.

Real-time monitoring of equipment
The system has a visual real-time monitoring function, the work quality of the staff can be monitored when the staff patrol work, to ensure that the staff does not miss the situation [10]. Visualized real-time monitoring can also view the specific situation of the device task point in real time, so as to ensure that the device is in the normal operation mode.

3.2. Simulation training effect
Real-time simulation training can also be carried out in this system to help new employees to master the content of the patrol work in time. The system can summarize and save some problems encountered in the daily inspection work, and give solutions to the problems. New employees in the initial phase can be simulated practice, using the system for simulating task point in the daily work of inspection, and the feedback report, and then on the basis of the system to provide solutions to solve the problem, so that new employees have a deeper understanding on work processes, skilled to master the content of work.

4. Conclusion
The inspection work of substation seems to be more complicated in our daily life, but the content of this work is full of necessity. It is the existence of these workers and their serious attitude to work that can make our daily production and life have reliable dependence. The establishment of the inspection system can make the daily inspection work simpler and more reliable for the inspection staff to a large extent. The staff only need to use the handheld inspection device to inspect each task point and edit and feedback the specific situation of each task point, thus changing the traditional recording work. The system will make a comparative analysis of the feedback data uploaded by the staff, so as to provide the equipment status report to the manager, and the manager will decide whether to maintain the task point. The system also has the function of simulation training, this function can let the new staff in-depth understanding of the work process, and will appear in the daily work of some problems for simulation exercise processing, so that the new staff quickly master the work content. This paper starts from the substation inspection work, analyzes the traditional inspection work, and then puts forward a new concept, so that the traditional inspection work can become more concise and effective.

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