The Construction of Cloud Computing System for The Optimization of Medium Voltage Non-Blackout Operation Equipment and Tools

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Abstract. With the continuous development of cloud computing technology in China, cloud computing technology has been widely used in various fields of production. Because there are some defects in traditional automation medium voltage power outage operation equipment and tools, and the application of cloud computing technology in medium voltage power outage operation equipment and tools can effectively improve the production rate of products, thus promoting the development of medium voltage power outage operation equipment and tools. Therefore, this paper first briefly explains the advantages of cloud computing technology, and briefly discusses the application of cloud computing technology in the automatic control of medium voltage non-blackout operation equipment and tools, for readers' reference.

Keywords: Cloud Computing Technology, Management Mode, Fault Diagnosis, Practical

1. Introduction

With the rapid development of electric power industry, China's production level has been significantly improved. However, the application of cloud computing technology in the automatic control of medium voltage non-blackout operation equipment and tools in China is still in its initial stage, and there is still a lot of room for improvement. Therefore, the application of cloud computing technology should be strengthened in the operation equipment and tools of medium voltage power failure [1].

2. Advantages of cloud computing technology

2.1. Cloud computing technology
Cloud computing technology refers to people's understanding of the normal operation and control process of electricity, and the establishment of control model with computer technology, so as to improve work efficiency (as shown in Figure 1, the application of cloud computing technology in medium-voltage non-blackout operation equipment and tools). Therefore, the application of cloud computing technology can effectively improve the production efficiency and reduce the management difficulty of electronic enterprises.

![Image](image_url)

**Figure 1.** Application of cloud computing technology in medium voltage non-power outage operation equipment and tools

### 2.2. Advantages of cloud computing technology

#### 2.2.1. Optimize the maintenance of automatic control system. With the promotion of cloud computing technology, the use of cloud computing technology in the automatic control of medium voltage non-power outage equipment and tools can optimize the maintenance of the automatic control system. The management of the automatic control system of medium voltage non-blackout operation equipment and tools is relatively complex, which will involve the detection of relevant data. When the error of data is checked by manual means, it needs to spend a high labor cost to find out the error in the data. Therefore, in order to improve the maintenance of the automatic control system of medium-voltage non-blackout operation equipment and instruments, and strengthen the application of cloud computing technology, this problem can be effectively solved, so as to ensure the normal operation of the automatic control system of medium-voltage non-blackout operation equipment and instruments [2,3].

#### 2.2.2. Improve the accuracy of the control model. When the automatic control system of medium voltage non-power off operation equipment and tools is in normal operation, the control data of the design model is always in a state of fluctuation, so it is difficult to master the control program. At the same time, because people cannot predict non-subjective reasons, it will affect the control model. The application of cloud computing technology in the automatic control system of medium voltage and non-power outage operation equipment and tools can reduce the interference of non-subjective factors on the control model, thus improving the accuracy of the control model.

#### 2.2.3. Improve the convenience of the automation system. The control rate of the traditional automatic control system of medium voltage non-blackout operation equipment and instruments is relatively low, so enterprises need to invest more human resources to manage the automatic control system of medium...
voltage non-blackout operation equipment and instruments. The automatic control system of medium voltage non-power off operation equipment and tools uses cloud computing technology to realize remote control of the control device and self-adjust according to the parameters of the control model, thus reducing the working pressure of relevant staff.

To sum up, by using cloud computing technology, electronic enterprises can optimize the maintenance of automatic control system, and at the same time can control the control device from a distance [4,5].

3. Application status of automation technology

Traditional automation technology is used in the automation control of medium voltage non-blackout operation equipment and tools. When the equipment fails, it is necessary to deal with the fault manually. Because the staff lacks sufficient understanding of some equipment failures, it will cost a lot of human resources in the process of handling the fault. In addition, the defense mode of the traditional automatic control system of equipment and tools in medium-voltage non-power outage operation is relatively low, so there are potential security risks in the operation of the system.

4. Application of cloud computing technology in automatic control

In medium voltage power operation using cloud computing technology in equipment and instrument automation control, to optimize the medium voltage power not the design of the operating equipment and instrument, improve the ability of equipment fault handling, can optimize the environment of electrification staff working at the same time, strengthen the medium voltage power operation equipment and instrument automatic control system of the safety performance.

4.1. Optimize the design of equipment and tools for medium-voltage non-power outage operation

In the traditional design of medium voltage non-power outage operation equipment and tools, the designer obtains the data needed for the design of medium voltage non-power outage operation equipment and tools through manual test. However, the data obtained from manual test has the problem of low accuracy, as shown in Figure 2 below:
Figure 2. The overall architecture and application of cloud computing technology

By using cloud computing technology, designers can complete design links such as independent drawing, planning analysis and simulation with the help of computers, and store the obtained data in the database, thus improving the accuracy of the whole design process and optimizing the design of equipment and tools for medium-voltage non-blackout operation.

4.2. Application of fault diagnosis

In the operation of the automatic control system of equipment and tools in the medium voltage without power failure, it is inevitable that the equipment failure will occur. When the equipment fails, it is necessary to rely on professionals to check and deal with the equipment failure. Adopting manual way to deal with equipment failure, not only wastes the time to deal with equipment failure, but also is difficult to grasp the accuracy of equipment problems. Through the use of cloud computing technology, the fault inspection of the equipment under the intelligent control device can not only pass the accuracy of the processing of equipment problems, but also shorten the processing time of equipment problems [6-8].

4.3. Provide convenience to staff

Electrical automation staff in high temperature or noisy working environment, affect the work efficiency. Through the use of cloud computing technology, when the distance between the staff and the managed equipment is relatively far, the equipment can be controlled by remote control, thus simplifying the working procedures, reducing the input of the enterprise on labor costs, and optimizing the working environment of the staff.

4.4. Ensure the safety of system operation

With the complexity of network environment, the automatic control system of medium voltage non-power off operation equipment and tools may be attacked by viruses, which will bring a threat to the
normal operation of the system. Through the use of cloud computing technology, virus data can be collected and analyzed. Through the understanding of known virus information, viruses that may attack the system can be prevented in advance, so as to improve the security of the normal operation of the system.

5. Cloud computing technology and its energy-saving design measures

The application of information technology in medium voltage power failure operation is discussed briefly in the following aspects of energy saving design.

5.1. Reasonable optimization of distribution system performance

In the energy-saving design of cloud computing technology for medium voltage non-power outage operation, the distribution system can be reasonably optimized to improve the performance of the distribution system, so as to achieve the purpose of energy saving.

![Figure 3. Design of equipment and tools for medium voltage non-power outage operation](image)

For example, in Fig. 3, the electrical energy utilization rate can be improved by increasing the area or lengthening the length of the conductor for the distribution system's conductor cross section. In addition, attention should be paid to the coordination of medium voltage power outage operation and information technology to avoid affecting the quality of medium voltage power outage operation [9].

5.2. Integrate PLC automatic control concept

In the energy-saving design of cloud computing technology of electric and gas engineering, the integration of PLC automatic control concept can not only strengthen the information construction of medium voltage power failure operation, but also help to improve the quality of medium voltage power failure operation. By integrating PLC automatic control concept into cloud computing technology, automatic control of disconnecting switches, circuit breakers and other facilities can be realized. At the same time to provide automated fault diagnosis service automation system, through the automation system to evaluate potential hidden trouble, according to the evaluation results to complete automatic
repair, saved to electronic automation system maintenance time, at the same time also reduce the maintenance cost of automation system, so as to improve the comprehensive benefit of the enterprise.

5.3. Preferred automatic electric energy device

5.3.1. This transformer. In the design of energy saving, the transformer should be made of copper to reduce the consumption of electric energy in the transmission process. At the same time, combined with the electric load of medium voltage non-blackout operation, when the transformer cannot bear the required transmission load, the transformer load should be up-regulated.

5.3.2. Free compensation device. In order to improve the capacity space of the electrical automation system, it is necessary to use the free compensation device in the design process of the automatic power device, so as to improve the stability of the automation system.

5.3.3. Active filter. The function of active power filter in electrification engineering is that active power filter can eliminate harmonics when electric power engineering system suffers from harmonic infringement, so as to ensure the normal operation of electric power engineering automation system.

5.3.4. Resistor. Combined with the actual situation of medium voltage non-blackout operation line, the selection of appropriate resistor can effectively reduce the energy consumption of medium voltage non-blackout operation. In addition, resistors with better performance can be selected in order to improve the stability of medium voltage non-power outage operation equipment. For example, large area resistors or high temperature resistors with certain good properties [10].

5.3.5. Reduce the loss of automation equipment. Energy-saving design is mainly to reduce the loss of energy during the use of equipment. Therefore, in order to achieve the purpose of energy saving, energy saving design to choose less energy consumption of electrical materials. For example, for the choice of conductor material, a conductor with low resistivity can be selected. In view of the choice of lighting equipment, new lighting materials such as fluorescent lamp, LED and sodium lamp can be selected to improve the utilization rate of electric energy.

6. Conclusion

With the rapid development of productivity in our country, the application of intelligence should be paid attention to in the automatic control system of medium voltage non-blackout operation equipment and tools. Through the use of cloud computing technology, the staff can realize remote control and management of the electrical automatic control system equipment. When the equipment fails, the fault point of the equipment can be found timely and accurately for processing, thus reducing the input of the labor cost of the electronic enterprise and improving the comprehensive benefits of the enterprise.

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References
1] Shen Z, Hu E, Deng S, et al. The Control Strategy for the Adaptive Reactive Voltage of Low and Medium Voltage Distribution Network with High Photovoltaic Penetration[J]. IOP Conference Series: Earth and Environmental Science, 2021, 657(1):012103 (6pp).

2] Beekhuis C W. Computer implemented systems and methods for start-up, calibration and troubleshooting of an installed renewable energy system[J]. 2009.

3] Carrillo J J. Process for initializing and updating the topology of a high-voltage or medium-voltage electrical power station[J]. US, 2005.

4] Radmilovi-Radjenovi M, Sabo M, Radjenovi B. Application of multi-component fluid model in studies of the origin of skin burns during electrosurgical procedures[J]. Computer Methods in Biomechanics and Biomedical Engineering, 2021(1):1-10.

5] Schwarzer U, Doncker R. Characterization of 6.5 kV IGBT modules for hard- and soft-switching operation in medium voltage applications[J]. Biochemical & Biophysical Research Communications, 2005, 404(1):448-52.

6] KS Kim, BK Kwon, S Bang,. Development of a 7-Level Medium Voltage Inverter System with PWM Converter for Regenerating Operation[J]. IEEE, 2006.

7] W, W, Wladimiroff, et al. The construction and operational analysis of an interference-free, coaxial N2laser system[J]. Journal of Physics E: Scientific Instruments, 2001.

8] Rodriguez J, Hammond P W, Pontt J, et al. Operation of a medium-voltage drive under faulty conditions[J]. IEEE Transactions on Industrial Electronics, 2005, 52(4):1080-1085.

9] Martini L, Bocchi M, Ascade M, et al. Development, Testing and Installation of a Superconducting Fault Current Limiter for Medium Voltage Distribution Networks[J]. Physics Procedia, 2012, 36:914-920.

10] Saleem M Z, Kamran M, Amin S, et al. Chlorodifluoromethane (R22) Gas and Its Mixtures with CO2/N2/Air as an Alternative to SF6[J]. Journal of Electrical Engineering and Technology, 2021(4).