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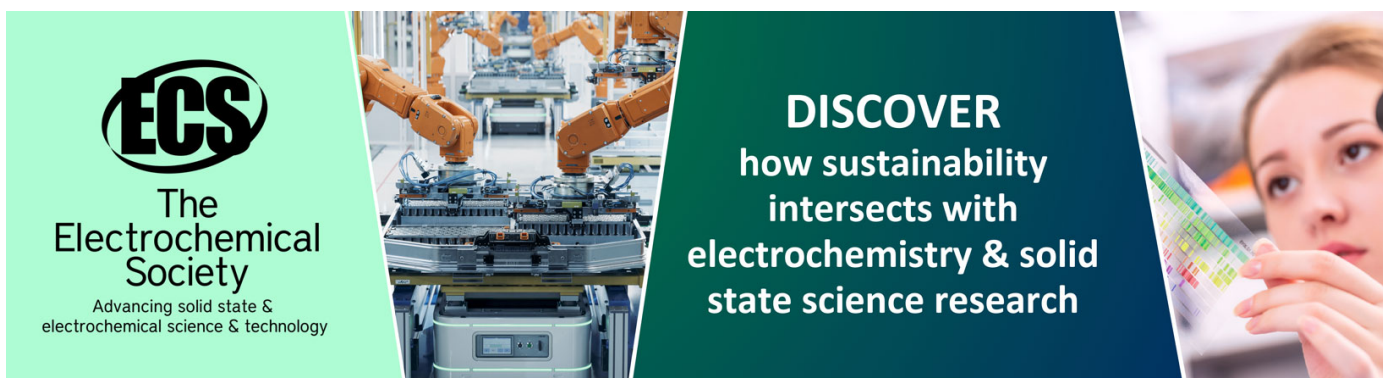
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Research on an EMS-based Spare Power Automatic Switching Control System for Network

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Abstract. The overall framework and operation logic of an EMS-based network automatic switchover system are introduced in detail in this paper. The system gets the information of power grid by reading the XML file, confirms the composition of the substation equipment and the bus line connection mode, uses the modeling tool to manually define the self cast operation model, establishes the data platform according to the IEC61970/CIM rule, and forms the real time data mapping; When the fault occurs, the 104 protocol is used to obtain the remote information, telemetry and protection action information of EMS. Based on the above real-time information, the operation object is searched to confirm the operation parameters, and a self-investment plan is automatically generated according to the judgment logic. The operation interface is displayed in an SVG vector diagram. It is of great significance to quickly restore power supply and improve the security of smart grid.

1. Introduction

With the continuous expansion of China's power grid and the improvement of users' power quality requirements, a new and higher requirement is put forward for real-time monitoring and analysis control of power grid operation. In order to ensure the reliability and stability of power supply, many substations have built-in self-powered devices. When the main power supply fails, the main power supply switch can be switched off and the standby power switch can be switched on to shorten the power outage time and reduce economic losses. Therefore, research and preparation of self-investment technology plays a key role in the rapid restoration of power supply in the event of a grid failure and in the improvement of the safety of the smart grid. However, the conventional self-contained device can only realize the automatic input of the local standby power supply of a single substation. When the operating power supply and the standby power supply are in different substations, the conventional standby self-investment cannot be used to restore the standby power supply. In response to the above problems, some areas have established self-investment control systems based on EMS. Many of them have chosen to have the self-investment system embedded in the EMS system. This kind of setting has high requirements for the safety check mechanism, and there are more risks. Secondly, when the transmission line fails, a large amount of alarm information is provided to the dispatcher indiscriminately within a short period of time. As a result, the dispatcher is often too late to handle and judge, which brings difficulties to find faults promptly, judge faults, analyze faults, and restore power. The EMS-based self-investment control system proposed in this paper can overcome the limitations of conventional self-investment, read the XML file to obtain grid information, confirm the substation equipment composition and bus wiring, and manually define the self-investment operation model. Establish a data platform in accordance with IEC61970/CIM rules to form real-time data mapping; use



the 104 protocol to obtain the remote information, telemetry and protection action information of EMS, and accurately extract accident-related information, and search for operating objects according to the above real-time information to confirm The operating parameters are automatically generated according to the judgment logic. At the same time, the system displays the grid wiring diagram and the plant station wiring diagram in the form of SVG vector diagrams to provide the user with an operation interface. It can assist line operation units to process and analyze intricate grid data more effectively, provide a more intuitive operating platform, improve the safety and accuracy of operations.

2. Design

Based on the EMS real-time information, the network is equipped with a self-casting operating system and is suitable for substations with voltage levels of 35kV, 110kV, 220kV, etc. It is suitable for the following operation system: Windows XP SP3, Win2003 system; server side uses IIS 5.1; client uses .NET Framework 2.0 /3.5; supports many kinds of network protocols. The system's structure, network interfaces, and hardware devices are all international standard models, with good openness, high compatibility, and strong scalability.

The system obtains the grid information by reading the XML file, confirms the substation equipment composition and the bus wiring mode, uses the modeling tool to manually define the self-investment operation model, establishes the data platform according to the IEC61970/CIM rules, and forms the real-time data mapping; In the event of a fault, the 104 protocol is used to obtain EMS telemetry, telemetry, and protection action information. Based on the above real-time information, the operation object is searched to confirm the operation parameters, and a self-investment plan is automatically generated according to the judgment logic. The structure of the system is shown in Figure 1.

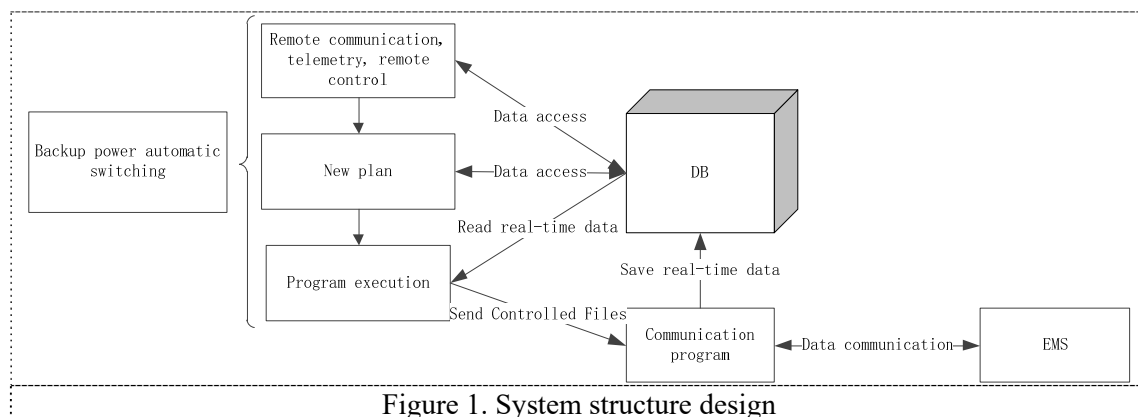


Figure 1. System structure design

3. Software design

The text of your paper should be formatted as follows: When the program runs, it checks the running status of the equipment according to the received real-time information to confirm the operating status of the transformer and the line. The status of transformers and lines can be determined by detecting the state of switches and switches. Based on the CIM model data, the wiring of voltage levels in substations can be automatically identified.

The system includes real-time data acquisition module, automatic program formation module, and program execution module. The real-time data acquisition module runs a background program to collect the required telemetry, remote signaling, and remote control values in real time to provide real-time data support for the self-investment operation.

3.1. Server-side process design:

The flowchart is shown in Figure 2.

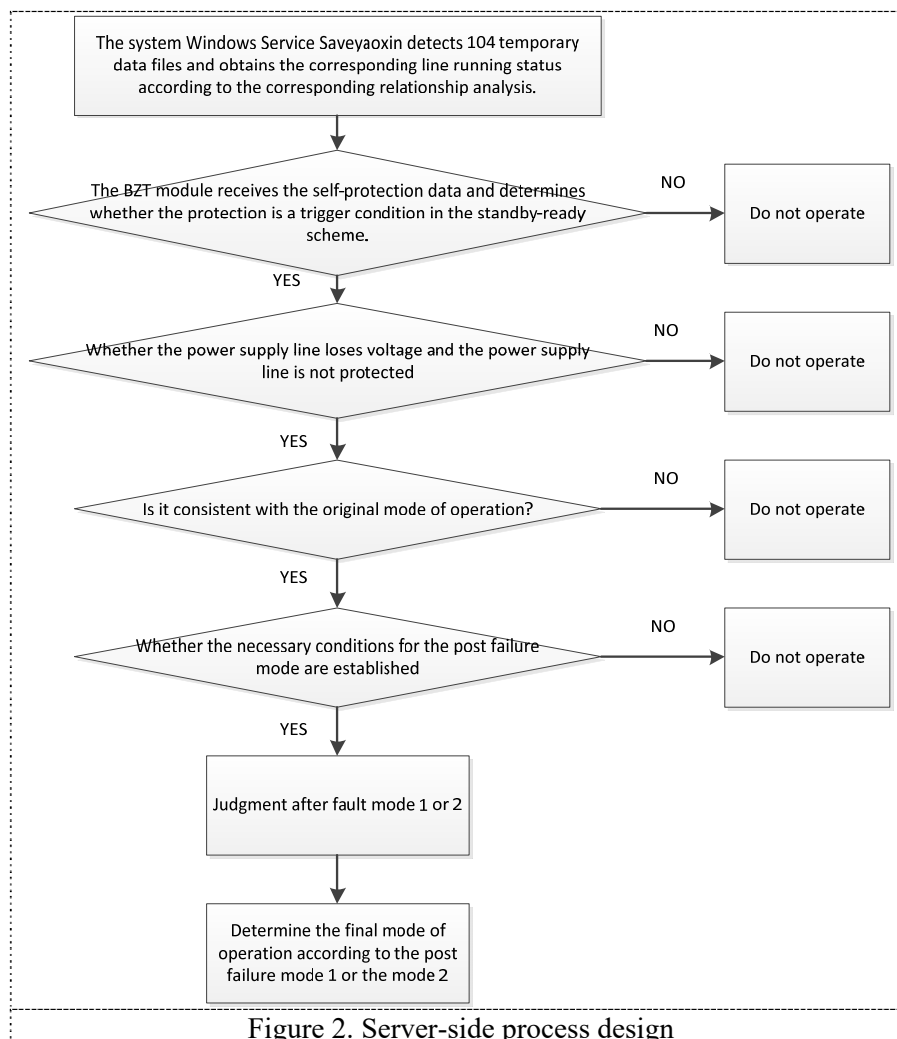


Figure 2. Server-side process design

3.2. main steps:

After receiving the SqlDataReader returned by Service Broker trigger stored procedure usp_GetBZT, the system process is divided into the following four steps:

Step 1 If the SqlDataReader has data, obtain its group number, remote signaling point number, type, and receiving time.

Step 2 Based on the information obtained from the investment source library BZT_Plan, determine whether the standby trigger condition exists in the library. If it exists, the condition is established, that is, the power line loses its voltage.

Step 3 Check whether the voltage loss protection of the power supply line exists and the power supply line is not protected.

Step 4 Query the steady state data according to the solution information. Steady state data conforms to the decision logic described above.

4. An example of automatic input operation of standby power based on SVG function

Scalable Vector Graphics (SVG) is a graphic format officially recommended by the International Electrotechnical Commission. It has advantages that are not available in other graphic formats. How to apply SVG technology to power dispatch automation is a matter of concern. The accident aid decision-making and fault real-time positioning system will graphically provide the user with an operation

interface. The SVG vector diagram will be used to successfully display the grid wiring diagram and the plant station wiring diagram.

These images concentrate a large amount of data information, which can help the staff to process and analyze the intricate grid data more effectively, provide the system operators with a more intuitive operating platform, improve the safety and accuracy of operations, and provide correct decision-making for accidents. The following shows an example based on SVG-based self-investment function:

The example of "losing power at Tianqu station and putting Miao Zhuang station into use" is shown as follows:

4.1. Fault type A

4.1.1. *The mode of operation after failure:*

The 220kV Tianqu station 113 is in the closed position, 220kV Miaozihuang station 2419 switch is disconnected, 110kV Beijiao station 1216 switch is in the unity position, and 110kV Beijiao station inside the bridge 1210 switch is disconnected.

4.1.2. *The operations that need to be performed:*

Open 220kV Tianqu station 113 switch, close 220kV Miaozhuang station 2419 switch, the result of the operation is shown in Figure 3.

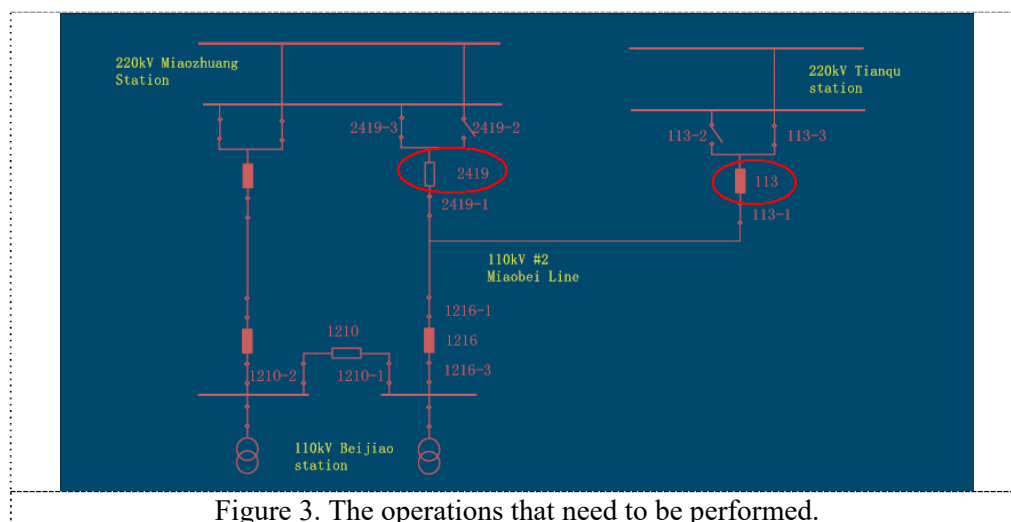
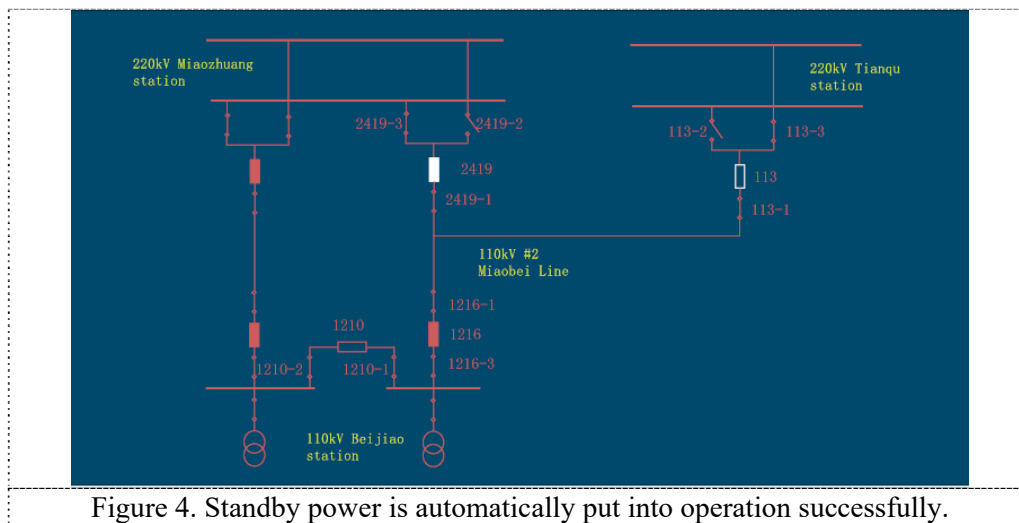


Figure 3. The operations that need to be performed.

"Standby power is automatically put into operation successfully", as shown in Figure 3.



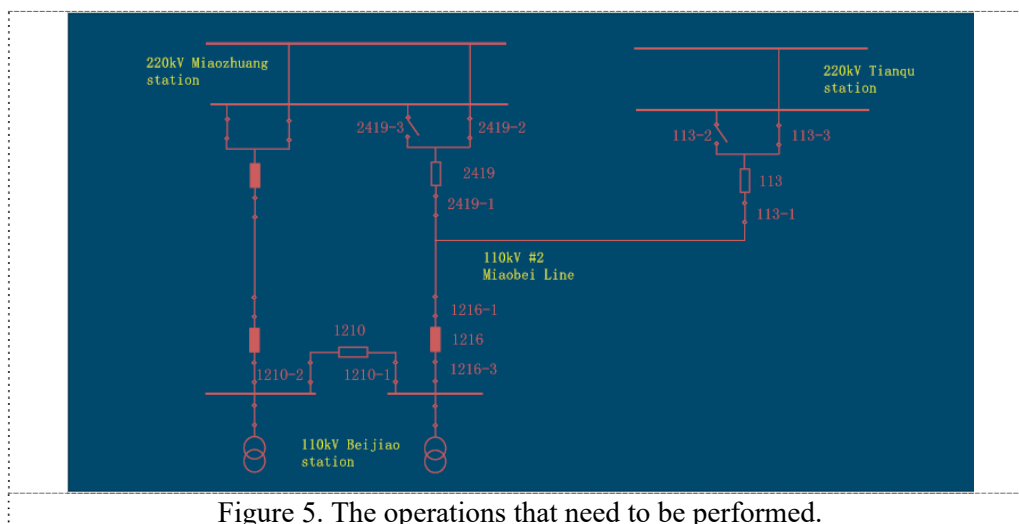
4.2. fault type B

4.2.1. The mode of operation after failure:

The 220kV Tianqu station 113 switch is disconnected, 220kV Miaozhuang station 2419 switch is disconnected, 110kV Beijiao station 1216 switch is in the unity position, and 110kV Beijiao station inside the bridge 1210 switch is disconnected.

4.2.2. The operations that need to be performed:

Close 220kV Miaozhuang station 2419 switch, the result of the operation is shown in Figure 5.



Do not perform "Execution", the operation timeout after 2min, as shown in Figure 6.

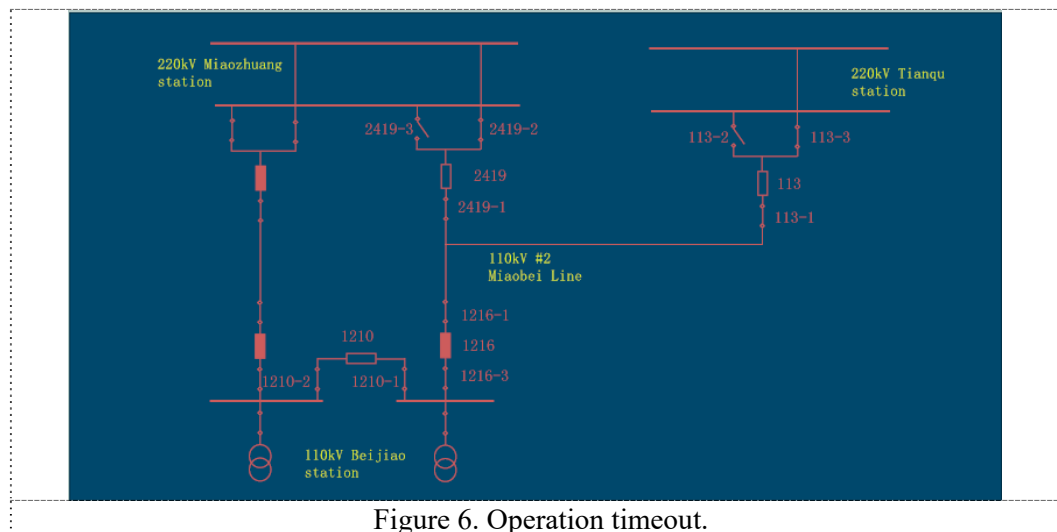


Figure 6. Operation timeout.

5. Conclusion

This article has carried on the thorough research to the substation preparation self-cast operation technology, introduced the self-investment judging logic and the type of self-investment operation scheme in detail, and on the basis of this proposed a real-time information based on the automatic identification of equipment running status. The self-reporting operating system enables real-time monitoring of the power grid operation and more intelligent analysis and control, greatly reducing the possibility of misoperation. It plays a key role in quickly recovering power supply during grid faults and improving the safety of smart grids.

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