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The Intelligent quality evaluation system of switchgear based on defect association rules

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I. INTRODUCTION

As the key equipment of the distribution network, the quality of the switchgear will directly affect the reliability of the power supply. By summarizing the on-site acceptance work of the switchgear, combined with part of the on-site investigation, it was found that the current acceptance work of the switchgear has the following problems: (a) The inspection work methods of various districts and county bureaus are not unified, and there is a lack of a unified acceptance index system. (b) The quality inspection data record of the switchgear is manually recorded, and there is no unified database record. (c) Lack of historical data analysis of switchgear acceptance, and lack of focus on acceptance work; (d) Lack of multi-level refined rating for switchgear quality assessment to distinguish the quality levels of various manufacturers. In view of the problems in the current acceptance work mentioned above, this paper proposes a Intelligent quality evaluation system of switchgear based on defect association rules.

II. QUALITY EVALUATION METHOD

Based on the field investigation of traditional acceptance work, this paper refers to "Southern Power Grid 12-40.5kV High Voltage Switchgear General Technical Specifications", "Southern Power Grid High Voltage Switchgear Implementation Quality Standards", "Southern Power Grid Equipment Standard Technical Book" and other related technical books. From three dimensions of appearance size indicators, mechanical performance indicators, and electrical performance indicators, a multi-level indicator system for determining the quality of switchgear has been constructed. This paper has established a defect database by collating the defect data of switchgear acceptance in recent 3 years. The Defects roughly divided into three categories: mechanical performance defects, electrical performance defects, and appearance dimensional defects. The defects are mined by association rules. The index weight is adjusted based on association rules by using equalization function, and the quality of switchgear is evaluated by fuzzy comprehensive evaluation method.

Frequent itemsets	Support	Confidence
Insulation resistance of main circuit---cable room size	0.36	1
Insulation resistance of the secondary circuit---Instrument room size---Voltage test of the secondary circuit	0.28	1
Secondary circuit withstand voltage test---meter room size	0.28	1
Secondary circuit withstand voltage test --- secondary circuit insulation resistance	0.28	1
Secondary circuit withstand voltage test---Instrument room size---Insulation resistance of secondary circuit	0.28	1
Insulation resistance of the secondary circuit---voltage test of the secondary circuit---dimensions of the instrument room	0.28	1
Insulation resistance of the main circuit---car identification---cable compartment size	0.28	1
Circuit breaker room components --- circuit breaker room nameplate identification --- cable room size	0.24	1

Table1. Defect correlation

III. SYSTEM DEVELOPMENT

A. System architecture

The overall structure of the system is mainly divided into three parts shown in Figuer 1: equipment layer, monitoring and processing layer and presentation layer.

B. Monitoring data communication network

The platform is equipped with mechanical arm, industrial camera, three-dimensional scanner, material detector and other sensors to collect the relevant detection information of the switchgear, process the collected original data, and transmit the processed data to the computer for analysis and storage. The data is transmitted to the database server by the switch for collection, storage and management, and the application server calculates and analyzes the data to provide online monitoring, quality evaluation, historical data analysis and visualization services.

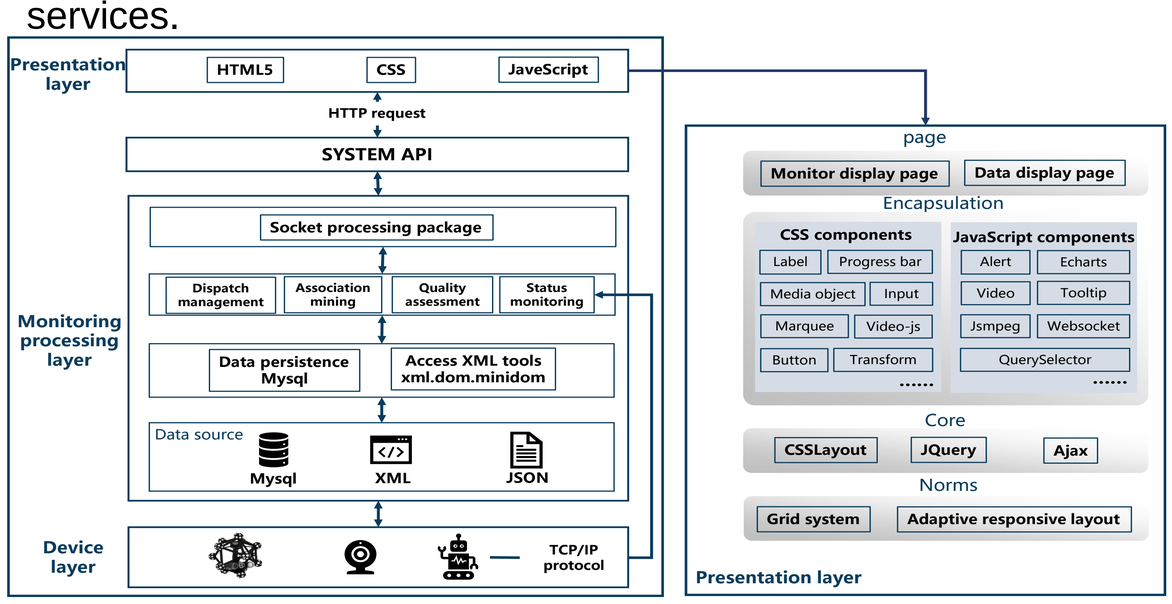

Fig.1 Testing platform and system interface

IV. EXAMPLE APPLICATION

Use the above-mentioned system shown in Fig.2 to carry on the quality inspection to 3 switchgear, among the judgement result is shown in Table V.

Fig.2 Testing platform and system interface

Switchgear number	evaluation result	Score (level)	Traditional test results
Switchgear 1	[0.3071,0.2929,0.4]	48.2834（Unqualified）	Unqualified
Switchgear 2	[0.5485,0.4515,0]	81.9400（excellent）	Qualified
Switchgear 3	[0.3509,.06491,0]	74.0360（Qualified）	Qualified

Table2. EVALUATION RESULTS

V. CONCLUSION

The quality inspection of the switchgear using this system can obtain the refined scores of the appearance size parameters, mechanical performance and electrical performance of the switchgear, which can provide data reference and method support for the purchaser selection and acceptance of the switchgear in the future.

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