Design and Realization of Intelligent Operation and Smart Grid Maintenance System for Data Center in Electric Power Supply

Dewei Lin1,*, Dongying Gao1, Zhijian Fang1, Fangfang Huang1, Jijuan Liu2
1Information and Communication Branch of State Grid Fujian Electric Power Co., Ltd., Fuzhou, Fujian, 350001, China
2State Grid Info-Telecom Great Power SCI. & Tech. Co., Ltd., Fuzhou, Fujian, 350001, China
*Corresponding author: deweilin@sgit.sgcc.com.cn

Abstract. The strong development of "Internet +" has had a huge impact on traditional operation and maintenance methods and models. When relevant industries use "Internet +" to transform their businesses, they must also transform their OAM (operation and maintenance) concepts to enhance their core competitiveness. Long-term research on system OAM methods has found that most of the current OAM of enterprises are still in the semi-automatic OAM stage, and the OAM personnel have to deal with repetitive, monotonous, complicated processes and errors. At the same time, with the growth of business, the number of servers has increased sharply, and the workload of OAM personnel has also doubled. This paper studies the design and implementation of the intelligent OAM management system in enterprise data based on information technology, understands the functional requirements of the intelligent OAM management system in enterprise data in related literature, and then designs the system according to the functional requirements, finally, the designed system is tested for function. The test results show that the maximum response time of the system is 0.71s and the minimum is 0.07s. This shows that the system is operating well, the integrated system has a higher performance than the previous system, responsive efficiency and more convenient operation mode. Different user logins have clearer permissions and more direct and smooth data interaction, which can significantly improve the efficiency of enterprise management and OAM.

1. Introductions
The construction of information technology not only improves the competitiveness of the company, but also brings huge challenges to the OAM of the system [1-2]. With the continuous development of information technology, the scale and number of enterprise servers have increased sharply, and the flexibility requirements of software development and the complexity of equipment maintenance have continued to increase. Related companies must fundamentally change the requirements, operation methods and maintenance [3-4]. The stable operation of any software is inseparable from the support of OAM. Only high-quality OAM can guarantee the normal operation of the business [5-6]. In recent years,
because the quality of OAM largely determines the quality of software and user experience, OAM have received extensive attention [7-8].

In view of the research on the intelligent OAM management system of enterprise data based on information technology, some researchers believe that although the application of bim can improve the efficiency of OAM management from the perspective of visualization and query of the information database, it effectively converts the information model to the continuous use of the information model in the OAM process will change the current information exchange process [9]. Some researchers also proposed an object-oriented model of the building electromechanical equipment property management information system, and used uml to model and describe its data structure. The related data structure was carried out in the process of building electromechanical OAM management. Analysis and design, and the relevant managers have completed the integration and management of the life cycle of building electromechanical equipment [10]. According to relevant information, it seems that OAM workers must devote 47% of their energy to implement software development and repair various problems caused by software development within a few years. In order to have a more reliable system, reduce OAM costs, increase productivity and improve software delivery capabilities, it seems necessary to change current software development and current OAM methods. There are also some scholars who mainly conduct research on automated OM from two aspects: continuous integration and monitoring [11]. However, studies have shown that most enterprises only implement semi-automated OAM, and even some small and medium-sized enterprises still perform manual OAM. Among them, semi-automated OAM are mainly retained in the OAM of scripts, while delivery links (accounting for most of the OAM time of the system) are often ignored [12].

This article explores the design and implementation of the intelligent OAM management system in the enterprise data based on information technology, summarizes the functional requirements of the intelligent OAM system based on relevant literature, and designs one by one according to the functional requirements, and finally designs well the system performs testing to test the relative performance and rationality of the system.

2. Research on Intelligent OAM Management System in Enterprise Data

2.1. Analysis of Functional Requirements of Intelligent OAM Management System in Enterprise Data

2.1.1. User registration and authentication function. The function of registration and user authentication is mainly the access and management of user information. According to the different functions of users, the user principle is designed, the system has two types of simple users and administrators. Detailed user functions include: user registration, login, information maintenance and other functions; the administrator has the authority of ordinary users, but also has functions such as user management, password reset, and user authority change.

2.1.2. Data access module. The data access module regularly loads data files and trace logs of different devices into the data warehouse to prepare for data analysis and mining.

2.1.3. Data analysis. Data analysis is a manifestation of converting data into purified data through preprocessing, data conversion and data mining. Data preprocessing is mainly to clear the relevant data again, such as deleting the date format error or the terminal code as a positive or negative number, and then carry out information conversion on the relevant data and according to the digital merger specification. Data conversion mainly refers to the conversion of all pre-processed data, including the type and format of the data.

2.1.4. OAM report viewing and generating module. Viewing the OAM report itself is the authority of the administrator, and creating the OAM report itself is the authority of the administrator. The OAM report view is provided for system users to view the created OAM report. The OAM report can choose
different date views, including: the first-level OAM report, that is, the current data status, and the second-level OAM report, which is, the potential problems in the history of equipment or mobile terminals.

2.2. Intelligent OAM Algorithm

(1) Cluster analysis.

Given that the observation set \( X = \{x_i\}, i = 1, 2, \ldots, n \), where each observation value is a \( d \)-dimensional real vector, \( k \)-average clustering is to divide the \( n \) observation values of the observation set \( X \) into the \( k \) set \( C = \{c_k\}, k = 1, 2, \ldots, K, \) and \( k \leq n \), so that the sum of squares in the group is the smallest. Let \( \mu_k \) be the mean value of \( c_k \), then the variance of each sample data and the mean value in each category is defined as:

\[
J(c_k) = \sum_{i \in c_k} \left\| x_i - \mu_k \right\|^2
\]

The goal of this algorithm is to minimize the variance of all \( K \) categories:

\[
J(c) = \sum_{k=1}^{K} \sum_{i \in c_k} \left\| x_i - \mu_k \right\|^2
\]

2.2.1. Clustering algorithm based on partition. The partition-based clustering algorithm divides a data set of a given size \( n \) into partitions \( k \), where each partition represents a cluster, and \( k \leq n \). This type of algorithm usually randomly selects the cluster center \( k \), and then assigns the remaining objects to the cluster represented by the nearest cluster center according to a division criterion (such as a distance-based distance function). Then, iteratively find new cluster centers by optimizing the object function, and redistribute the remaining objects until the cluster centers no longer change or the number of iterations reaches the limit.

2.2.2. Hierarchical clustering algorithm. The hierarchical grouping algorithm divides the existing data set into hierarchical clusters. This algorithm can be divided into two methods: aggregation and separation. Compression and separate hierarchical grouping use bottom-up and top-down strategies respectively to organize objects into a hierarchical structure. The aggregation method first treats each data object as a separate class, and then merges small classes into larger classes until the number of classes is met or other termination conditions are met. The separation method first treats all data objects as one class, and then subdivides the large class into many small classes in successive iterations until the termination condition is met. Different algorithms will choose different similarity or dissimilarity measures as the basis for merger or disintegration.

The basis for merging or splitting in hierarchical clustering algorithms is the similarity or dissimilarity between groups. This measurement criterion can be quantified as the distance between groups. Commonly used distances between clusters include minimum distance, maximum distance, mean distance, and average distance B7. The distance is defined in the following formula, where \(|p_i - p_j|\) is the distance between data objects \( p_i \) and \( p_j \), \( m \) is the mean value of \( C \), and \( n \) is the number of objects in the group \( G_i \).

2.2.3. Clustering algorithm based on density. It is difficult to find non-spherical groups in partition and hierarchical methods, while density-based methods can find clusters of any shape. Density-based methods use object density limits as the grouping criteria. High-density areas form clusters, and low-density areas form clusters or intervals between extreme values, and are not sensitive to abnormal data.
3. Design of Intelligent OAM Management System in Enterprise Data

3.1. System Function Architecture
The system is mainly composed of four main functional modules: system user login authentication module, data access module, data analysis module and functional report maintenance module. The operating structure diagram of this system is shown in Figure 1 and will be used to display the functions that must be met by the input units.

Figure 1. System function architecture diagram.

3.2. Registering the Login Module

3.2.1. Identity authentication. In order to perform identity verification, the automated system OAM system used in this document has a dual identity verification function with a password and an IP address. Before running the system, the system administrator will create users that allow users to access the system one by one, and set up initial passwords and corresponding IP access rights for them. After the setting is completed, the legal user name, password and corresponding IP address will be stored on the system. When a user logs in, it first checks whether the user name exists, and if the user name does not exist, the user is denied access to the system. When the user is on the system, please check the current IP address and the corresponding IP address of the user stored on the system. If they are the same, they do not match and access will be denied. If they match, continue to check whether the entered password matches the password stored on the system; if it does not match, the user will only be denied access if the user name you entered exists. The user is allowed to access the system only if the password you entered and the IP address you have access to match the password and IP address stored on the system.

3.2.2. Role management. The concept of role capacity has also been added to the automated system OAM system applied to this document to improve system security. Role capacity is defined as the number of Internet users with a specific role in the system within a specific period of time, and the role capacity is determined when the role is created. For example, in this system, the roles of file manager, room manager and system administrator are all 1. That is to say, among the online users of the system, there is only one user as file manager, room manager and administrator log in. In the current system, the file manager user has logged in, when another user wants to log in as the file manager, he/she will refuse to log in to ensure system security.

3.3. Data Access Module
(1) Data collection function, the user selects the add button in the Data Acquis. jsp interface to call DataAccessAddInfo, the interface fills in the required information such as collection name, IP port, database type, and then calls the Add Modify method of the DataAccess object to add data to the Data Access table and calls DataAccess the List Info method of the object finds the data in the database and refreshes it.
(2) Data cleaning function, the user uses the DataCleanAcess function to call the Data Read method of the DataAccess object in the Data Clean. jsp module to read the data in the Hisstrjn table in the data source, and then calls the Data Check method of the DataAccess object to check and clean up the data, and use the Data Write method to write enter the table of Oracle's Hisstrjn Deal, and a prompt of data cleaning completion will pop up on the front page.

3.4. Data Analysis Module
The data analysis module is the core part of the intelligent OAM management system in enterprise data. It mainly performs data preprocessing in the background for existing data or resources, and uses K-Means and Apriori algorithms for data mining, and writes the results to the database of the system is easy to display.

3.5. OAM Report Viewing and Generation Module
The OAM report view includes the first-level OAM report and the second-level OAM report. The first-level OAM report is the fault of the current system that the user can. The secondary OAM report allows users to view the possible problems of the equipment after data analysis.

4. System Performance Test
The system needs to have a higher response efficiency, so the response time of the system needs to be tested. The test results of the response time of this system are shown in Table 1:

| Module                                      | Minimum time (seconds) | Average time (seconds) | Maximum time (seconds) |
|---------------------------------------------|------------------------|------------------------|------------------------|
| Register login module                       | 0.007                  | 0.012                  | 0.041                  |
| Data access module                          | 0.023                  | 0.035                  | 0.063                  |
| Data analysis module                        | 0.024                  | 0.033                  | 0.052                  |
| OAM report viewing and generation module    | 0.012                  | 0.056                  | 0.071                  |

![Figure 2. System performance test.](image)
It can be seen from Figure 2 that the maximum response time of the system is 0.71s and the minimum is 0.07s. This shows that the system is operating well. Compared with the previous system, the integrated system has higher response efficiency and more convenient operation. Different user logins have clearer permissions and more direct and smooth data interaction, which can significantly improve the efficiency of enterprise management and OAM.

5. Conclusions
The rise of "Internet +" has promoted the rapid growth of related industries, and these industries have given full play to the role of the Internet in promoting industrial transformation and upgrading. However, technological reforms have also brought unprecedented shocks to enterprises. The system is getting larger and the number of servers is increasing, which increases the pressure of enterprise OAM. In this case, in order to better reduce the pressure of business OAM, ensure the stability of the system and improve the user experience, this paper designs an automated OAM system. It is concluded through experiments that the system is operating well, and the integrated system has a higher response efficiency and a more convenient operation mode than the previous system. Different user logins have clearer permissions and more direct and smooth data interaction, which can significantly improve the efficiency of enterprise management and OAM.

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