ISSN: 2414-1895 DOI: 10.6919/ICJE.202401_10(1).0045

Application of Power Communication Resource Data Verification based on RPA

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Abstract

The importance of power communication system resources data is increasingly prominent as an important foundation for the development of the power industry. In order to solve the problem of high manpower cost in the online and offline data verification of power communication resources, this paper applies RPA to data verification, using RPA layered system architecture to connect multiple systems, complete data collection and screening, and achieve automatic verification of power communication resource data. Experimental results show that RPA-based data verification has significant effects in cost saving, abnormal data retrieval, accuracy, and security, addressing the long-term pain points of communication resource data verification.

Keywords

RPA; Power Communication; Data Verification.

1. Introduction

Power communication resource data, as an important part of power data assets, has high requirements for the working methods, requirements, collaborative relationships, and other key elements for accurate reconciliation of power communication network resource data in daily work [1]. Since the launch of the Telecommunication Management System (TMS), in line with the principle of data sharing among provinces, cities, and counties, power communication resource data has started online entry, while the offline routing table is frequently used for communication field construction, operation and maintenance, and spring and autumn inspections, making its update and maintenance essential. Due to factors such as the complexity of resource change processes, long occupation periods, and insufficient maintenance personnel, online and offline resource maintenance does not occur in real-time synchronization, resulting in “breakpoints” between online and offline data. Therefore, staff need to regularly conduct consistency comparisons of online and offline communication resources according to corresponding rules to ensure the consistency and accuracy of the routing information on both sides, to better support intelligent demands and field operation and maintenance. In actual work, manual periodic comparisons are time-consuming and inefficient, and given the increasingly dense data verification, the purely manual model is inadequate. In the event of an urgent data verification request, the task arrangement becomes chaotic, leading to a series of chain problems, wasting a significant amount of personnel time and not aligning with the company's work philosophy of improving quality and efficiency.

With the development and application of intelligent tools in various professions, we consider using Robotic Process Automation (RPA) to handle such large, complex, and evolving data, which has been the subject of many related studies. Zhu Yingqi believes that the trend of automation devices gradually replacing manual labor is inevitable, and by conducting demand analysis on companies, the

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design and implementation of RPA-based office automation can solve pain points for enterprises [2]. To date, RPA has been fully improved and innovated in the field of finance and has developed into a mature digital application technology to replace traditional manual labor [3]. Tang Yanqi believes that RPA brings new opportunities and challenges to the audit industry, as RPA audit robots bring innovation and also pose risks that need further optimization and development [4]. Sullivan believes that RPA applied to international logistics can reduce the workload of professionals and create higher efficiency [5]. In the field of power, the application of RPA robots has shown good effects in intelligent acquisition of electricity consumption data [6] and massive electricity consumption data statistics and retrieval [7], with obvious advantages over traditional methods.

Through the application of the above research, to minimize human errors, ensure the real-time consistency of online and offline communication resource data, and further improve the quality of resource data, we consider using RPA technology to automatically compare and verify online and offline electric communication resources, in order to safeguard the security of electric communication services, and have a positive impact on the operation of the electric communication network.

2. RPA Model

The existing communication resource data includes tens of thousands of records such as optical cable accounts, optical path accounts, optical path routing, business accounts, and business routing information. The rules for comparing online and offline data are fixed and standardized, which is suitable for RPA to simulate human operations and judgments. We consider using RPA to record user operations, processing these operations into computer language, and allowing the computer to execute operations and determine tasks based on rules [8].

A typical RPA platform consists of development tools, running tools, and a control center. The development tool is the design and production tool of RPA, allowing developers to write programs and request robots to execute specific instructions. The running tool is used to run related programs or view running results after completing the development tasks and generating robot files. The control center can deploy and manage robots, including starting or stopping robot operations, creating schedules for robots, and redeploying robot tasks.

The RPA robot in this article adopts a layered architecture, consisting of server layer, client layer, and execution layer. The server and client use existing frameworks to collect and analyze data, including the subsequent automated processing of data. The running tool in the computer is the execution layer responsible for executing specific programs. The robot simulates manual operations in the TMS system and Excel client interface, collects data, classifies, and matches it in the background, processes it according to rules, and provides feedback on the results. In addition, this architecture provides terminal ports to maximize meeting user requirements, expanding the scale of the architecture, fully utilizing the functions of RPA, allowing navigation between business platforms, forming a system structure that is comprehensive and interconnected, as shown in Figure 1.

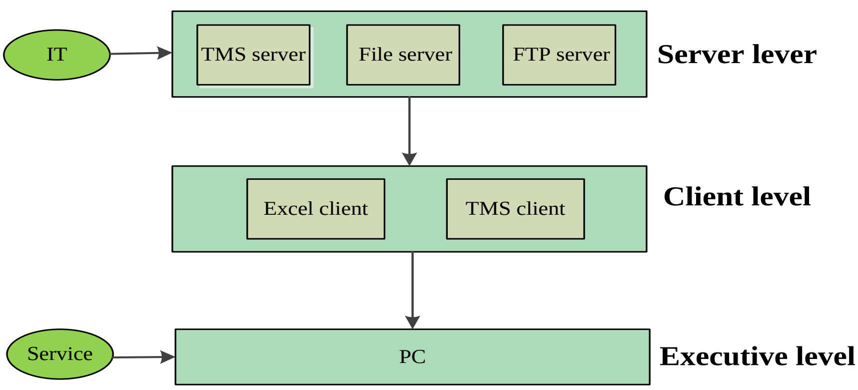

Figure 1. System Workflow

This article is based on a plugin-based RPA solution and verification rules to achieve automatic verification of online and offline power communication resources data, and the RPA program is developed using the Python language. Under normal operation, users only need to click to execute the RPA program, and the robot can automatically log in to the TMS system and access the relevant resource accounts. Depending on the data type, different scripts and rule codes are called to compare the results with offline resource data. Ultimately, the robot marks any abnormal information in Excel, completing the verification of both sets of data. The verification process is shown in Figure 2. This system does not change the existing servers and can be deployed on any computer with a working environment.

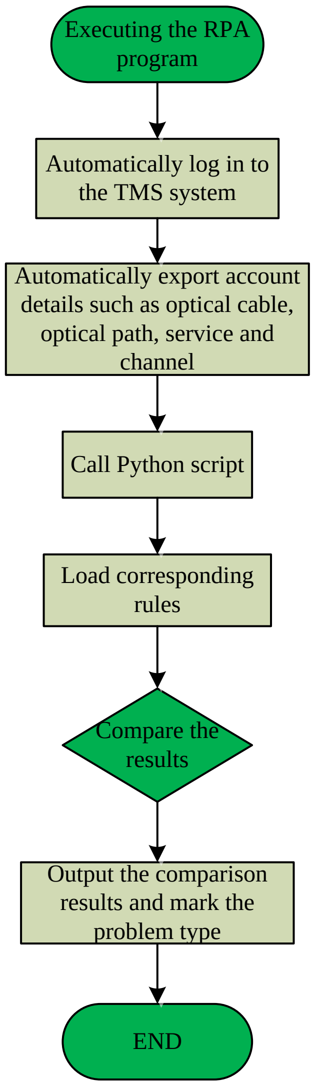

Figure 2. Data checking workflow based on RPA

3. Analysis of the Application Effectiveness based on RPA

After the execution of the power communication mode, it needs to be archived in the TMS system to summarize the execution status and leave a record, and after archiving, relevant business accounts can be generated online and the mode-related attribute fields can be automatically modified.

After archiving the mode, the synchronization of offline and online resource data updates is required. The resource data update requires a complex change process, and if the update is not timely or not standardized, it will result in inaccurate resource system data, impacting the management of communication resources, and increasing the difficulty of communication scheduling, mode optimization, and maintenance audits. Therefore, it is necessary to ensure the timeliness,

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standardization, and accuracy of resource updates during the data update phase. Resource data updates include online optical path wiring, channel business association, offline routing accounts, and routing information changes. The offline resource update is shown in Figure 3.

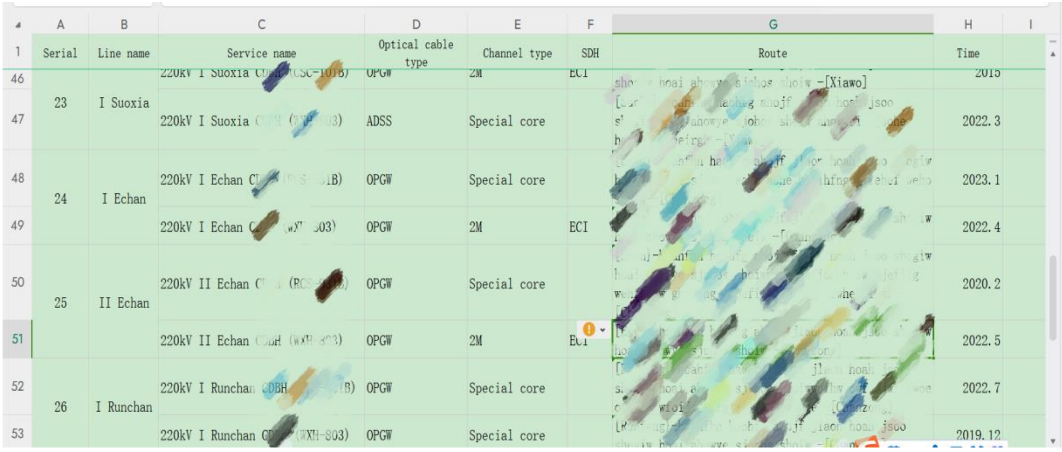

Figure 3. Offline resource update

Data comparison can be carried out after the data update is completed. Different types of resource data require the invocation of different data verification rules and the specific identification of key fields. For example, for optical cable accounts, it is necessary to compare whether the cables (sections) are missing or duplicated, and whether 11 fields such as the line name, serial number, type, core number, and length are accurate; for business accounts, it is necessary to compare whether 11 field attributes such as the line name, business name, scheduling level, channel type, and routing information are consistent; for channel information, it is necessary to compare attributes such as the stations passed, cable information and fiber core usage, and port at both ends. Many field attributes involve the conversion of Chinese and English, numbers, and identifiers, and these fields need to be specifically identified. Taking the protection business account verification as an example, the verification process is shown in Figure 4.

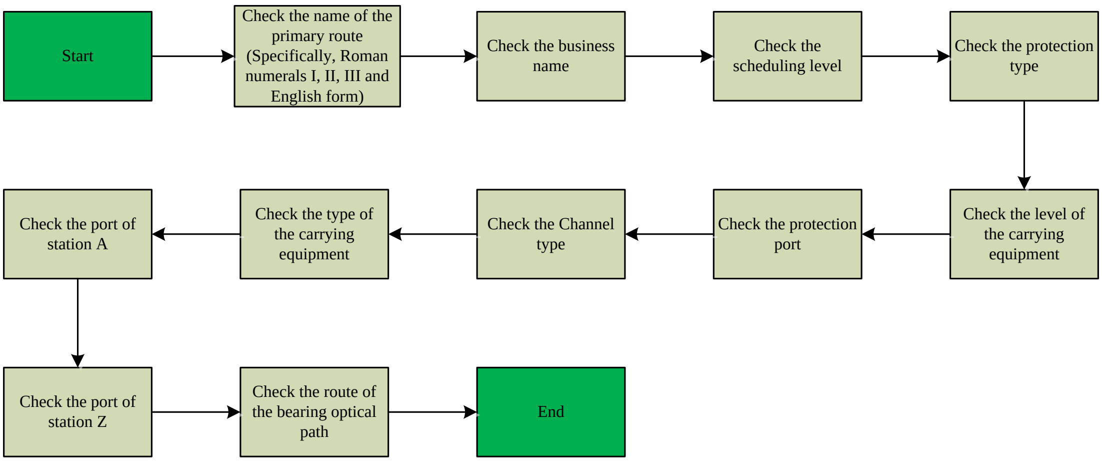

Figure 4. The process of business account verification

3.1 Manual Comparison

If the TMS system accounts are manually compared with the offline routing table, after the resource data is updated, it is necessary to manually export the optical cable, optical path, and business online accounts from the TMS system, with attention to filtering conditions during export. The business routing table can be filtered according to the business type such as protection, security, scheduling

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data network, and comprehensive data network[9]. The data is organized in a tabular form for comparison.

During the comparison, it is necessary to manually select key fields and mark them in a timely manner. The comparison results of the provincial company business accounts are shown in Figure 5. It can be seen from the figure that each type of data requires a step-by-step comparison of multiple column attribute fields to distinguish whether the data is consistent and the reasons for inconsistencies.

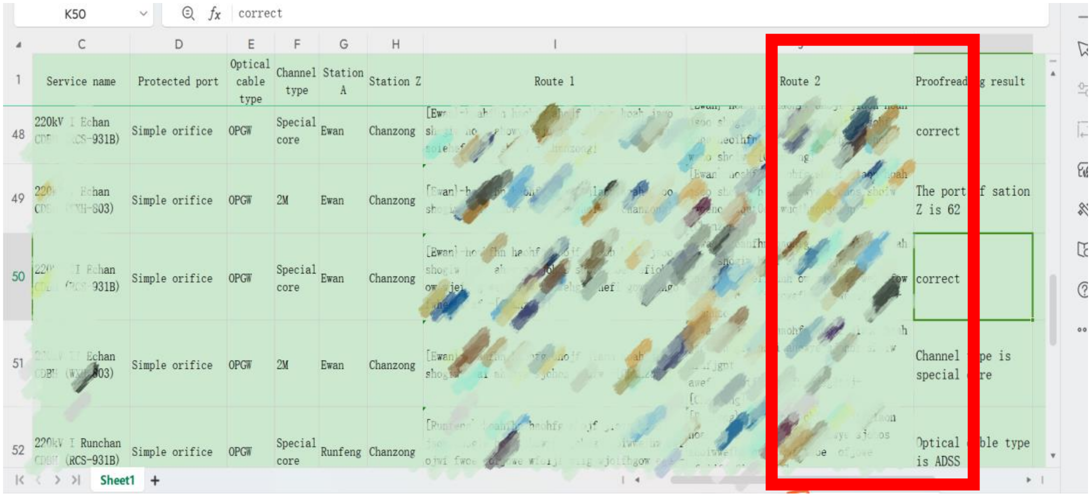

Figure 5. The results of manually comparison

3.2 RPA Robots Comparison

If automated comparison is performed using RPA robots, RPA can simulate manual operations in the TMS and Excel interfaces, automatically select attribute fields and export the detailed route details of the TMS system online accounts, call related scripts, load the corresponding type of verification rule library, output the verification results, and annotate the problem types in detail, as shown in Figure 6.

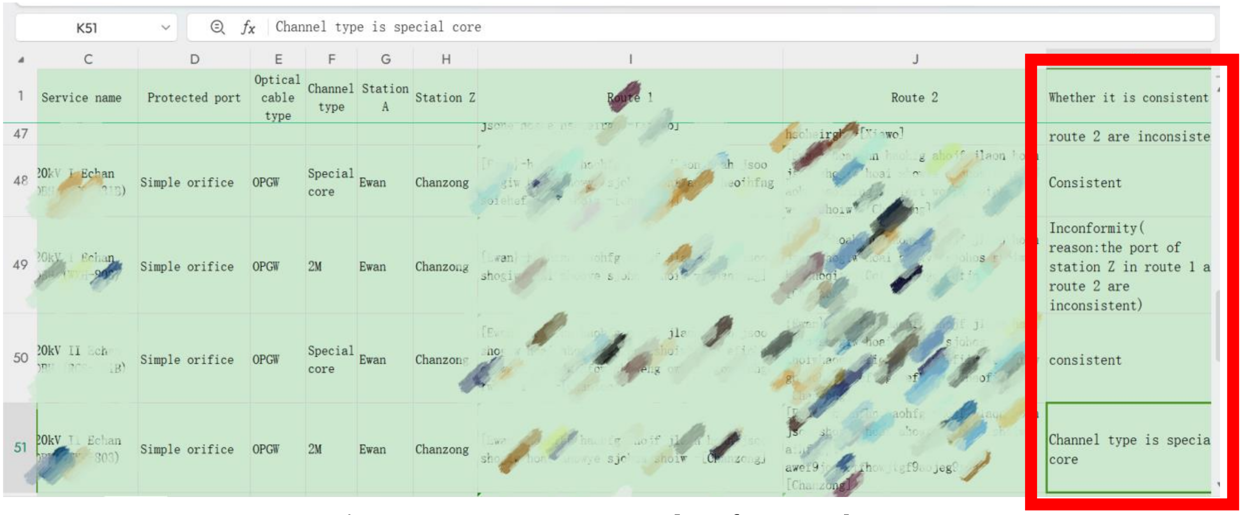

Figure 6. Comparison results of RPA robots

Based on the workload of resource data, manual comparison can only be conducted quarterly, averaging 1-2 times per quarter, with an average efficiency of 2 person-months per comparison. The RPA robots' efficiency is 8 minutes per comparison, saving an average of 1-2 person/months and increasing the data verification rate by a thousandfold, while also reducing the probability of human error in comparison. Due to the significant improvement in data verification efficiency, dedicated personnel can conduct data verification on a daily or weekly basis, ensuring real-time data consistency and achieving a "single source" of data, shortening the time for communication resource scheduling, mode optimization, and maintenance business verification. Furthermore, periodic data verification further enhances the accuracy of data, truly achieving standardized management of accounts, reducing errors in resource data, and lowering the probability of erroneous decisions due to inaccurate data, ensuring the safety and production of communication professionals.

4. Conclusion

This paper adopts RPA robots to achieve automatic data verification of power communication resources. By using the RPA hierarchical architecture pattern, the characteristics of multi-system structure can be fully connected, and RPA records data output operations and processes them into computer language. For different types of resource data, it automatically calls corresponding data verification rules, identifies key fields, and outputs verification results. The experiment proves that the efficiency and work quality of communication resource data verification based on RPA have been greatly improved, significantly reducing labor costs. Specialized personnel can carry out data verification and governance at any time, and the accuracy of important production business has reached 100%. Based on this, the third-level network maintenance ticket of Henan Company has realized one-click reporting of business affected, and in case of equipment cable impact on business during faults, one-click analysis has been achieved, providing strong support for the intelligent development of communication and the digital transformation of the company.

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