The Development of Integrated Centralized Control Platform for Electricity Meter Verification Device

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Abstract: The verification of power equipment in power grid is one of the basic guarantees to ensure the normal operation of power grid system. It is necessary to carry on the related verification to the electric power equipment of different specifications and models to ensure the functions, performance and stability of the equipment, so as to ensure the normal, safe and accurate operation of the power grid system. In this paper, a kind of electric energy meter verification device is designed. The verification platform can control the electric energy meter verification devices of different manufacturers and different models to carry out automatic verification of electric energy metering equipment. The verification platform is highly expandable, so long as the driver of the control device is implemented according to the interface method stipulated by the verification platform, the device can be seamlessly integrated into the verification platform.

1. Introduction
With the development of the power industry, various electric energy measuring devices are widely applied in power management systems [1-3]. So far, it is hard to detect different kinds of acquisition terminals for electric energy measuring devices. On the one hand, the product quality of acquisition terminal is quite different and may be poor, leading to difficulty on detection in a short time; on the other, the function of electric energy measuring devices is too unitary, which is unable to systematic detection. Therefore, it is promising to develop an effective and comprehensive detection platform [4-8].

This study aims to develop an integrated intelligent detection platform. Under the arrangement of this platform system, the following test items can be realized. 1) Able to control different types of watt-hour meter verification devices. 2) Set the verification scheme of the electricity meter on a verification interface according to the verification procedures. 3) The verification scheme can be set flexibly, and can be copied, modified and deleted. 4) The software interface is simple and easy to operate. 5) Automatic verification of all verification items of various electric energy metering equipment, such as ordinary electricity meters, standard electricity meters, multi-functional electricity meters, intelligent electricity meters and electric energy meter verification devices, according to verification regulations. 6) Verification data can be backed up. 7) It can realize the automatic storage and printing of a large number of different original record forms and verification certificate forms. 8) Verification data, original records and verification certificates can be uploaded to the marketing automation system. 9) With query and statistics functions. 10) Able to print verification statistical reports and scheduling sheets.
2. System function

2.1. MIS interactive system
In order to obtain the information of the electricity meter for the verification of the product, there are also the work of uniformly issuing the verification scheme and uploading the verification data. The centralized control system needs to communicate with the south network marketing management system (MIS system). However, because the South Network has a unique system, so the need for data conversion and uploading work. It can be used as an intermediate link between the centralized control system and MIS system.

2.2. User operating system
This system is similar to the function of the original watt-hour meter verification software of various manufacturers, and it is the most complex design in the whole centralized control system. Because he needs to carry out verification operation, equipment state monitoring and management, verification data management, verification scheme management, electricity meter information entry (use the scanning gun to scan the bar code of electricity meter), and verification process monitoring and other work. It need humanity and stability.

2.3. Equipment control system
This system is the largest modification of the centralized control system. The original different manufacturers of equipment communication protocol for standard transformation. The reason why this system is needed is that the platform software needs to conduct real-time communication operation control with verification equipment of different types, different manufacturers and different models, and operate and manage uniformly on the platform. The verification devices of single-phase and three-phase watt-hour meters are connected to the verification platform uniformly. Watt-hour meter verification devices with different manufacturers, models and types can be connected to the centralized verification platform. New equipment and new function extensions also facilitate access to the verification platform.

This system adopts the "C# dynamic library" technology, which compile the communication protocol of the verification equipment into standard dynamic library files, which can be used as the control method of the equipment on the platform to carry out real-time communication and data acquisition on the verification equipment, and realize the soft unification of the platform. Figure 1 shows the connection diagram of the communication interface of the system.
2.4. **Verification project management**

This system is mainly to transform and manage the verification scheme, and to transform and translate the scheme issued by MIS according to the regulation requirements.

2.5. **Statistical inquiry and analysis system**

The main job is to run log management, print certificates and report centralized printing. After the centralized management of data is adopted, the verified reports, certificates, notification of results and other statements will be managed by centralized printing and management.

3. **Technical methods**

System integration include computer software, hardware, operating systems, database technology, network communication technology, such as integration, product selection, and different manufacturer with integration, system integration to achieve the goals - the best overall performance, that is, all parts and components after together, not only can work, and the whole system is low cost, high efficiency, performance, symmetrical, scalability, and maintainable system.

3.1. **Research on centralized control of equipment**

There are various kinds of electricity meter calibration devices, and there are new devices in the future, and the control protocols of various devices are quite different. Table surface number, function is not the same. In addition, most of the existing testing devices are independent units without unified external communication interface. Therefore, a set of independent and extensible interfaces are redesigned to realize control access of different manufacturers to the greatest extent, and the extended interfaces are reserved to facilitate the access of subsequent verification devices.

3.2. **WCF technology research**

The set of control system is different from the single system, there are two sets of systems, the master and the client, and there are many irregular communication master and client information. If use the traditional TCP communications, each kind of data interaction to custom rules, there is a very large
workload, but WCF is to provide a unified, can be used to build service oriented application of safe, reliable, efficient development platform. The biggest advantage of WCF is that it establishes a basic structure for Communication between applications, which can integrate the original, present and future Communication modes together and provide a unified programming model. For the communication protocol used, it is configurable and customizable. WCF is designed with the situation you mentioned completely in mind. If a new communication protocol appears in the future, we only need to implement some interface and customize your own communication entity. WCF has the following advantages: 1. Unity; 2. Interoperability; 3. Safety and reliability; 4. Compatibility.

3.3. Research on communication optimization
Commune with the machine body, the way in which baud rate is low or single frame is longer, there is a body serial port server forwarding the subcontract to send, check software after accepted by processing a frame to wait for a period of time after the judge if there is any subsequent frames, the time is usually 10 ~ 100 ms, namely whether the communication to the conclusion that there must be a waiting time, each data interaction is such a message waiting time, test time is longer. In order to solve this problem, a new communication method is studied in the development of centralized control platform system. A frame-by-frame verification mechanism is added to the underlying data communication. Since each frame has a communication protocol, various protocols have a verification mode, and there is no need to wait after receiving in this way.

Specifically, if the data is sent in three frames, A, B, and C: 1) If frame A fails to pass the acceptance completion test, save frame A and continue to wait; 2) After the acceptance of frame B, A + B is combined, the verification fails, A + B frame is saved, and the wait continues; 3) After the acceptance of frame C is completed, A + B + C is combined, the verification is passed, and the data acceptance is completed. The end of the communications.

4. System operation analysis
Through the prototype pilot operation, in the actual verification work, the equipment of various manufacturers and various types of electricity meters were simulated verification, and the rationality and practicability of the system were verified. It is of great help to the verification work. The trial run was a complete success and received unanimous praise from the verifiers, but the trial run working group thought that the experience effect needed to be improved.

After a trial run, the prototype system was confirmed to be of great help after a trial run. The work burden of verification personnel is effectively reduced. The reliability and efficiency of the verification process are guaranteed. The design tenet of standardization, standardization, process and humanization is established. Provide a unified, standardized and consistent operation process for electricity meter verification devices. Reduce related problems and learning costs caused by different software configuration of verification devices. Improve the working efficiency of verification staff. It unifies the format of original verification records and verification certificates, standardizes the management of certificates and improves the management level of enterprises.

5. Conclusion
To sum up, a set of software is used to realize the automatic verification of the electricity meter. The software is used to control the electric energy meter verification devices of manufacturers to realize automatic verification of electric energy meters. Unify the interface of meter calibration software, standardize the verification process of various electric energy metering equipment, reduce the work burden of inspectors and improve the efficiency of electricity meter verification. Unify the verification software of electricity meters, standardize the work of electricity meters, and improve the management level of enterprises.

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