

Intelligent measurement and detection method and application based on data visualization

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Abstract. In the rapid development of social economy and science and technology, data visualization has been widely used in all aspects of life and production, and began to play an important role in human daily life. In the traditional sense, the verification process of electricity meter needs to invest a lot of human resources and time cost, and the practical work efficiency is low, and there are a lot of mechanical and repetitive work. Under the influence of the theory of data visualization technology, the current intelligent measurement work has undergone brand new changes. Therefore, on the basis of understanding the research status of smart metering detection and according to the theoretical characteristics of data visualization, this paper deeply discusses the smart metering detection methods and application countermeasures with data visualization as the core.

Keywords: Data visualization; Intelligent; Measurement and testing; Verification technology

1. Introduction

After entering the era of big data, the Internet of Things has become an important basis for People's Daily life and work, and the measurement verification of electricity meters has undergone brand new changes. In the traditional sense, electricity meter verification needs to consume a lot of human resources, which can not only guarantee the efficiency and accuracy of work, but also improve the effect of intelligent verification and speed up the development of measurement and detection technology through the optimization and innovation of Internet technology. In essence, the Internet is through a variety of information sensing equipment, the real life items and the Internet connected together, thus completing the exchange and transmission of information, truly realize intelligent identification monitoring and comprehensive management, to ensure that network information can be seamless connection. The application of Internet of Things technology to intelligent measurement and testing can effectively release labor force and truly realize intelligent control. Electricity meter is the legal measurement instrument of electricity settlement.[1.2.3] In order to provide high quality power resources to social residents and ensure the accuracy of electricity measurement in the current urban construction and development, power enterprises put forward the data visualization theory on the basis of changing the traditional management mode. Data visualization refers to the scientific and technical research on the visual representation of data, in which the representation of data must be considered as a kind of information extracted in a summary form, including all the attributes and variables of information units. Since data visualization is an evolving concept and the corresponding boundaries are constantly expanding, relevant techniques and methods can use user interface, computer vision, image processing, etc. to visually interpret data in expression, modeling, and animation display. Compared with the special method of stereo modeling, data visualization includes a wider range of technical methods.

According to the analysis of the visualization technology schematic shown in Figure 1 below, the current data visualization technology includes the following concepts: First, data space. It is a multi-dimensional information space composed of data sets composed of n-dimensional attributes and M elements. Second, data development. It refers to the use of certain algorithms and tools for quantitative deduction and calculation of data; Thirdly, data analysis. It refers to the multi-dimensional data patch, block, rotation and other actions to analyze the data, in order to observe the data information from multiple angles and multiple sides; Finally, data visualization. It refers to the process of presenting the data in a large data set in the form of graphics and images,

and using data analysis and development tools to discover the unknown information. Nowadays, a variety of methods have been proposed for data visualization, which can be divided into several contents according to the differences in visualization principles, such as image-centered technology, distributed technology, hierarchical technology, pixel-oriented technology, geometry-based technology and so on.[4.5]

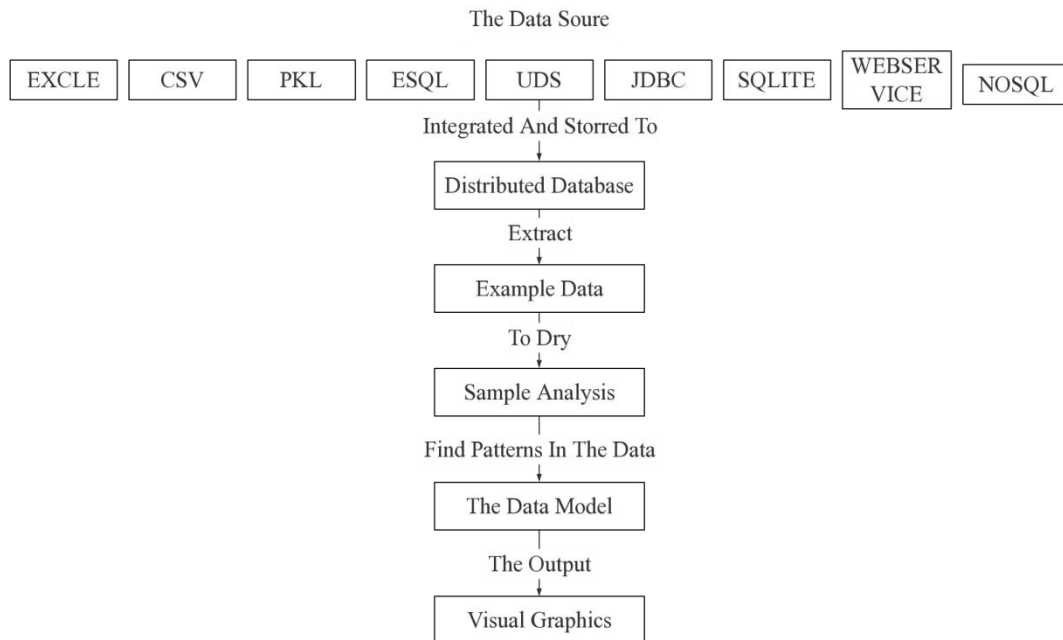


Figure 1 Schematic of the visualization technique

The traditional verification mode of electricity meters has basically realized the programmatic control of verification projects, but the whole process still needs manual delivery and distribution. Before testing, manual feeding, meter hanging and wiring are required. In the process of measurement and detection, manual inspection of the corresponding image is required. After testing, stitches and unloading table should also be carried out to analyze and judge the qualified and unqualified content. It can be seen that there is no effective detection method for the reliability of electricity meter wiring. If the poor contact leads to the continuous increase of the basic resistance, it will inevitably affect the final measurement and detection results. Therefore, in order to change the working mode of traditional electricity meter measurement and detection, ensure the life safety of workers, and improve the efficiency and quality of applied technical equipment, current scientific researchers have begun to discuss the skill intelligent measurement and detection method with data visualization as the core. Starting from the perspective of intelligent measurement detection, this paper deeply discusses the application method with data visualization as the core, so as to fully demonstrate the technical advantages of data visualization after forming a large-scale verification function.[6.7]

2. Method

2.1 Measurement and Testing

In the traditional working mode, electricity meters should fully implement the working mode of "centralized verification and unified distribution" according to the working requirements of local power enterprises. Provincial metering centers should conduct unified detection and analysis of electricity meters and then distribute them to urban power supply enterprises. Although this method really realizes unified management and can improve practical work efficiency, it faces many problems during the implementation because of the large number of work. Especially after entering

the era of big data, the traditional working mode has been unable to meet the development needs. In order to further ensure the perfection and accuracy of measurement and detection data, current scientific researchers have proposed an intelligent quality detection system based on big data and cloud computing platform. The specific module composition is shown in Figure 2 below:[8.9]

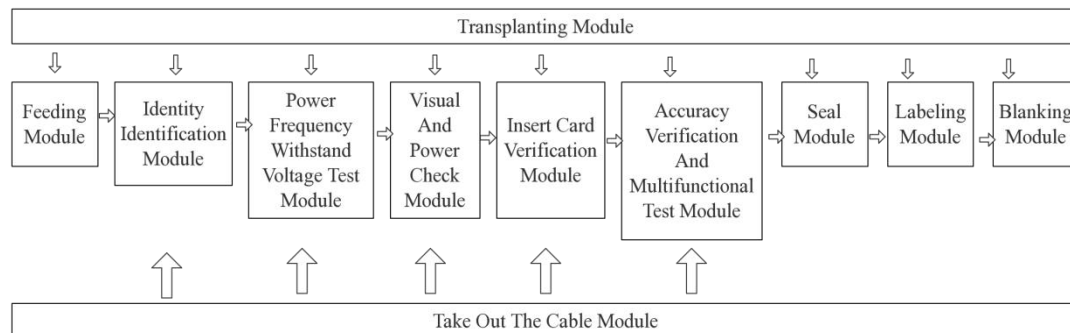


Figure 2 Structure diagram of system module

Nowadays, how to solve the development and design of intelligent measurement and testing system is the focus of the measurement and testing work of electric energy meters in electric power enterprises. In the process of practical design, the staff should comprehensively consider the influencing factors, on the basis of following the basic verification unit combination expansion method, comprehensively optimize the overall work flow, use new technologies and new concepts to solve the problems of tedious work and complex tasks, and ensure that the overall quality inspection work can achieve intelligent control. Intelligent measurement detection system mainly depends on the hardware and software system of mutual cooperation, use the big data frame are shown in figure 3 below, written in software programming, fully give play to the role of management platform, and hardware devices to giving full play to the advantages of high speed in the whole measurement process, help the department personnel to quickly complete the verification work.

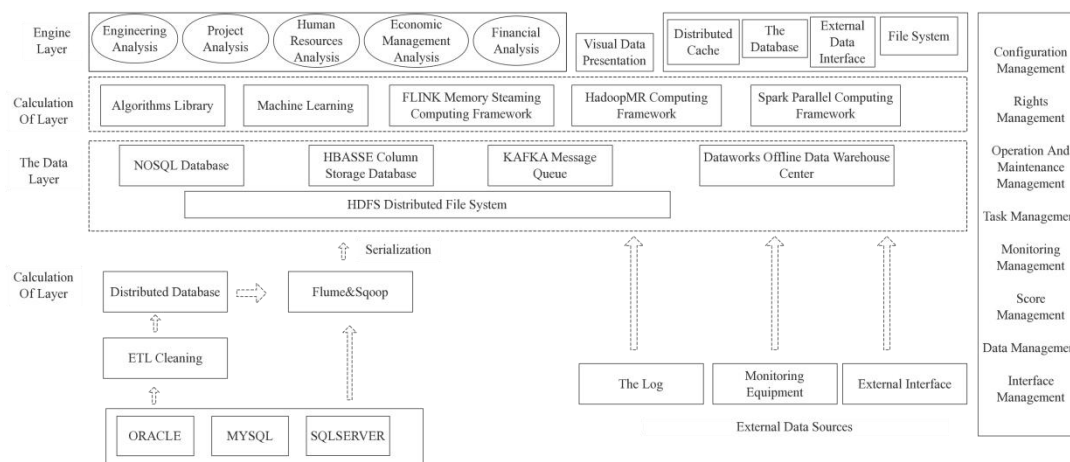


FIG. 3 Framework of big data

2.2 Detection Method

Smart metering detection based on data visualization framework is shown in figure 4, the combination of data visualization theory analysis shows that the practical measurement test data information directly presented to the staff, data analysis, can complete the value of each dimension, according to the classification, sorting, combination, thus made it clear that object or event data of multiple attribute or variable. At the same time, big data visualization allows workers to present complex information with short graphs, and even a single graph can achieve more information. Decision makers can easily interpret different sources of data, and the rich and varied graphics help employees in various departments understand current work issues and unrealized plans.[10]

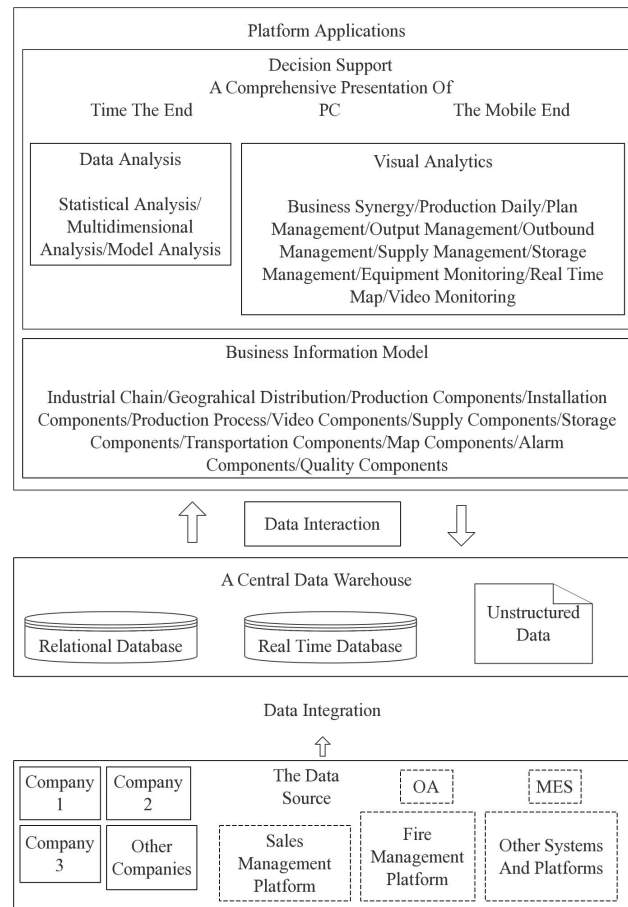


Figure 4 Visual detection framework

First, automatic suture removal technology. From the perspective of the whole process of intelligent measurement and detection work, this technology belongs to the basic task, which is mainly used to ensure the stability of electricity meters, and there will be no heating or displacement problems in practice. This link is also a prerequisite for the effective connection and smooth operation of the electricity meter and measurement detection device. In the process of manual detection, the staff should manually fix the detection line, the overall work efficiency is low. After the positioning of the meter, the cable removal technology can effectively connect the auxiliary terminals, current terminals, and voltage terminals to ensure the stability and balance of the voltage of the meter in the working state, without loosening or displacement. After removing the wires, it is necessary to ensure that the cable removal equipment and the electricity meter are effectively separated.

Second, automatic sealing technology. After passing the test, the electricity meter should be effectively sealed to prevent it from being opened directly without authorization, which is the basic condition to ensure the safe and stable operation of the electricity meter. In the design and application of electricity meters, screws are usually used to strengthen stability. In intelligent automatic management, it is difficult to ensure that the electric technology can accurately complete the threading work, so researchers proposed to solve the problem by using two-dimensional code sewing, which is to use laser technology to seal two-dimensional code in the front and back shell joints of the electricity meter, verification information can be visually presented through two-dimensional code. It should be noted that in order to avoid the two-dimensional code is destroyed, the staff can be optimized by sealing and pasting during the seal cutting. If you uncover the two-dimensional code surface seal paste, seal paste colloids will blur the two-dimensional code surface, resulting in the accurate identification of relevant information, and ultimately achieve anti-theft treatment.

Third, transplanting positioning technology. The detection of electricity meters needs many different links. In order to ensure that the measurement and detection work can be carried out efficiently and orderly, each link must be matched quickly. Sponge chuck transplanting technology and high voltage technology can be explored through experiments and stand out among many transplanting technologies to ensure that electricity meters can be effectively positioned in the whole measurement and detection process, so as to meet the needs of intelligent detection work.

Fourth, clock standard source network centralized control system. In the process of manual measurement and detection, the high-precision clock in the equipment should be regarded as the time standard, and the timing error of each electricity meter should be carefully detected. Generally, the second pulse will be selected as the output signal, and the error value will be clear in the comparative calculation. In the intelligent measurement and detection work, also need to do a lot of work, in this process also need to put forward the standard clock. Assuming that the pulse signal of a standard clock can be multiplexed, this signal can be output in the form of network to ensure the reliability of the conversion and transmission process of the signal source in the transmission process. After comparing and analyzing all the tested devices, the timing error of multiple devices can be determined.

3. Result analysis

According to the analysis of the data visualization flow chart shown in Figure 5 below, it can be seen that the intelligent measurement detection method mainly relies on the application of instruments and modern technology software, which can not only reduce the influence of human factors on the detection results, but also improve the practical operation and sales, and ensure the effectiveness and safety of the detected target. Under the guidance of data visualization technology, on the one hand, the automatic detection technology should be used to directly obtain the value and change trend of the detected object, on the other hand, the detection information directly obtained by the automatic detection technology should be integrated into the decision-making management, so as to help the staff quickly formulate effective management measures. It can be seen that intelligent measurement detection method based on data visualization is the main issue for future scientific researchers to continue to explore.

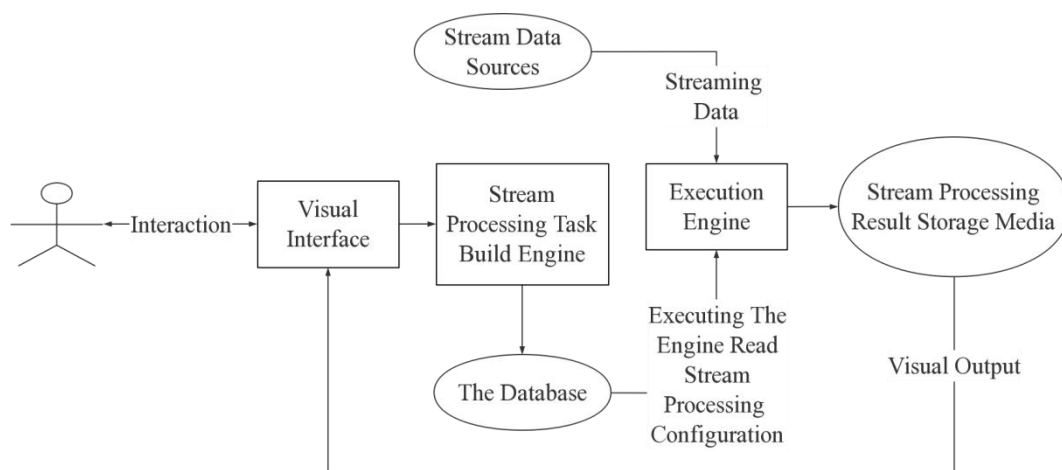


Figure 5. Flow chart of data visualization

4. Conclusion

To sum up, according to the experience of measurement and testing in recent years, building a new intelligent management system based on big data technology and cloud computing platform, and introducing the theory of data visualization technology, is helpful to present the working method with perfect functions, reasonable data and perfect information. Therefore, Chinese power

industry enterprises should pay attention to the innovation of intelligent measurement testing method, according to the practical work put forward the request, deep discussion of intelligent measurement testing function with the data visualization as the core, and improve the power industry development level. At the same time, we should strengthen the training of professional and technical personnel, learn from foreign advanced research results, and pay attention to guide our measurement and testing work towards the direction of intelligent and digital steady update.

Reference

- [1] Xiaodan Tian, Zhenguo Chen, Cen Chen, et al. Research and Application Situation analysis of domestic traceability technology based on bibliometrics [J]. Intelligent Computer and Application, 2021, 011(006):P.117-122,128.
- [2] Chengmin Zhou, Qin Zeng, Jake Kaner. Research analysis and prospect of Body-sensing Interactive intelligent Fitness Based on literature Visualization [J]. Packaging Engineering, 2022, 43(14):10.
- [3] Shengkai Li, Changshui Wu. Design of Automatic Parking target detection and Location based on radar Ranging [J]. Intelligent Computer and Applications, 2022, 12(6):7.
- [4] Fengxian Wang, Yi Liu. The Academic Prospect of Domestic Network Protest Research -- A Quantitative and Visual Analysis Based on CNKI Database [J]. Journal of Zhongzhou University, 2020, 37(1):6.
- [5] Ning Zhang, Shuang Liu, Xiaoyan Zhou. Key technologies and applications of smart grid based on digital visualization [J]. Digital Technology and Application, 2022, 40(2):3.
- [6] Ruiyang Sun, Xinyun Fang. Research on visualization of measurement test data based on PyEcharts [J]. China Metrology, 2021(3):5.
- [7] Min Yang. Analysis of global research status and trend of tuberous sclerosis based on bibliometrics and visualization technology [J]. Clinical Medicine Practice, 2022, 31(8):8.
- [8] Xiaodan Tian, Zhenguo Chen, Cen Chen, et al. Research and Application situation analysis of domestic traceability technology based on bibliometrics [J]. Intelligent Computer and Application, 2021, 11(6):7.
- [9] Zhihui Tu. Design of smart grid integrated data visualization management Platform based on cloud computing [J]. Electronic Technology and Software Engineering, 2020(14):2.
- [10] Qiuyue Li, Zhashi Li, Huaibi Zhao, et al. Visual analysis of research progress of intravenous drug deployment center in China based on bibliometrics [J]. China Pharmacy, 2022, 33(15):6.