On Line Monitoring System of Power Optical Fiber Transmission Network Under Internet of Things Technology

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Abstract. The traditional OTD power optical fiber transmission network online monitoring system takes a long time to monitor the network data, and the monitoring effect increases. Therefore, the power optical fiber transmission network online monitoring system under the Internet of things technology is designed. The sensor and microcontroller are designed in hardware. Analyze the functional requirements of on-line monitoring system in software; The data acquisition module of power optical fiber transmission network is established based on the Internet of things, and then the system software function is realized. By means of comparative experiment, it is verified that the online monitoring effect of the new system is better and has great popularization value.

Keywords: Internet of things technology · Power optical fiber · Transmission network · Online monitoring

1 Introduction

The safe operation of power system is related to the national economy and the people's livelihood. With the development of economy, the demand for electricity is increasing. Modern power system is developing towards high voltage, large units and large capacity, and the requirements for power supply reliability of power system are becoming higher and higher. At the same time, with the rapid development of information today, The rapid development of science and technology and the improvement of people's living standards year by year also promote the development of power system towards intelligence. Digitization and networking have become an inevitable trend [1]. The State Grid Corporation of China first announced the development plan of "smart grid" in 2009. The smart grid is based on an integrated, high-speed two-way communication network and combines advanced sensing and measurement technology, information and communication technology, analysis and decision technology, automatic control technology and energy and power technology, And a new modern power grid formed by high integration with power grid infrastructure [2]. Strength, interaction, automation, informatization, environmental protection and economy are the main characteristics of smart grid. Smart

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grid requires to be able to monitor the operation status of power grid in real time, find faults and recover itself in time with as little manual intervention as possible, so as to improve the safety and reliability of power grid operation. Smart grid includes six links of power generation, transformation, transmission, distribution, dispatching and power consumption in the power system. It can realize observability (monitoring the state of all equipment in the power grid), controllability (controlling the state of all equipment in the power grid), complete automation (adaptive and self-healing) and comprehensive optimal balance of the system (optimal balance between power generation, transmission and distribution and power consumption) So as to realize cleaner, efficient, safe and reliable operation of power system [3].

The intelligence of power grid puts forward higher requirements for the safe operation of power system. There are many factors affecting the safe and stable operation of power system, one of which is the operation safety of power equipment [4]. As the key to connect the six links of smart grid, substation is an important power facility in the power system to transform voltage, receive and distribute electric energy, control the flow direction of power and adjust voltage. It connects the power grid at all levels and plays a key role in the power system. The safe and normal operation of power equipment in substation is one of the most important factors to ensure the safe transmission of power in power system.

In the power field, the implementation of the periodic maintenance system of equipment based on time cycle provides a certain guarantee for the safe operation of power equipment. However, this maintenance method is affected by both objective factors (such as fixed cycle, maintenance experience, different operating environments of different equipment, etc.) and subjective factors (such as rigid work, lack of manual inspection, missed inspection, etc.), which makes this maintenance method expose a variety of problems: low reliability in the station, many power outages, large workload of personnel and high maintenance cost [5]. With the increasing contradictions exposed by the traditional maintenance methods and the rapid development of power industry and power supply technology, the on-line monitoring technology of substation equipment came into being. However, there are many problems in the early monitoring, such as poor stability, signal distortion, backward technology, non-specific monitoring standards, large installation workload and difficult maintenance. Although this monitoring technology can greatly improve the safe operation of power grid, due to the prevalence of the above problems, most online monitoring systems have the problems of unreliable data, nonstandard data and data can not truly reflect the equipment status, which can not play the role of monitoring the equipment status, thus hindering the popularization and Application of this new technology. At the same time, most of the on-line monitoring equipment of various manufacturers in the substation work independently, and carry out data acquisition, data analysis and result output respectively, which makes the data structure incompatible and lacks unified management. With the gradual development of technology and the gradual increase of problems, we realize the necessity of establishing a unified, comprehensive and intelligent intelligent online monitoring equipment online monitoring system.

Internet of things technology is in line with the needs of this actual development. The Internet of things has the ability to obtain, analyze, process, control and feedback information, and can realize the integration of human society and physical system [6].

The application of Internet of things in the construction of intelligent substation is the inevitable result of the development of the information age to a certain extent, which can realize the real-time management and control of equipment. Using the Internet of things technology, through the perception of the external world, an infinite sensor monitoring network is constructed to monitor the operation status of online monitoring equipment in an all-round and real-time manner.

In the existing power system equipment monitoring applications, they are basically connected through wired media. In the implementation process of wired lines, the quantities are large, the lines are not easy to expand, and in some special geographical environments and sites, the wiring will be limited and can not be implemented. Wireless sensor networks communicate wirelessly, which not only gets rid of the constraints of wired, but also has the advantages of strong mobility, easy expansion and upgrading [7]. With the continuous development of sensor technology and communication technology, wireless sensor network has been gradually applied to the field of on-line monitoring of substation power equipment.

The Internet of things connects all kinds of power supply and electrical equipment, and has been widely used in the field of smart grid. It is the main trend and direction of power system development. The application of Internet of things technology to the on-line monitoring of power equipment in intelligent substation is of great significance to ensure the safe and stable operation of power system. At the same time, it is of great significance and practical value to ensure the safe and stable operation of on-line monitoring equipment, improve the automation level of substation and promote the digital and networked development of intelligent power network.

2 Hardware Design

2.1 Sensors

The sensor designed in this paper has the functions of current sensing, ultrasonic sensing, digital temperature sensing, micro water sensing and pressure sensing. Electromagnetic BCT-2 type is adopted for current sensing function, which can realize on-line monitoring of insulation characteristics of most high-voltage electrical equipment by measuring leakage current. The sensor has strong electromagnetic field anti-interference ability and excellent temperature characteristics. The iron core is made of platinum nickel alloy with high initial permeability and low loss, and the iron core is fully automatically compensated through deep negative feedback to ensure that the iron core works in an ideal zero flux state [8]. The sensor adopts active zero flux technology to ensure the high accuracy and stability of low current detection, and can detect leakage current signals as small as milliampere (mA). It can be conveniently used to accurately measure the insulation characteristics of CT, CV, OY and TB with small leakage current. Its core structure can also ensure the sampling safety of electrical equipment and signals. Wireless temperature sensing capability is a new type of temperature sensing module that integrates the functions of wireless RF chip and digital temperature sensing. The temperature monitoring is collected by the temperature and humidity sensing module HMP155 of Vaisala company. HMP155 temperature sensing module has automatic calibration function and

RS485 communication interface. It can send temperature signals through its own communication protocol. In addition, it can also set serial port parameters, data acquisition method, query historical data, etc. Users can transplant ZigBee protocol into nodes to form simple star topology networks and complex tree and mesh networks. The sensing module can be applied to the fields of high-voltage substation equipment and high-voltage switchgear temperature measurement in intelligent substation. The ultrasonic sensing function is made by using the principle that piezoelectric ceramics will produce mechanical deformation varying with voltage or frequency under the action of voltage, and piezoelectric ceramics will produce charge when receiving vibration. When making, two pieces of piezoelectric ceramics or piezoelectric ceramics and metal sheets can be used to make a vibrator (double piezoelectric chip element). When ultrasonic vibration acts on the double piezoelectric chip element, an electrical signal will be generated. The type of ultrasonic can be judged by the electrical signal.

Ultrasonic sensing function, with convenient installation (it can be fixed to the equipment surface during installation), and the ultrasonic wave can pass through the metal shell and will not affect the surrounding equipment. Therefore, it can be widely used for partial discharge measurement inside closed high-voltage metal equipment such as GIS, which also provides guarantee for the safe and reliable operation of closed substation equipment. Therefore, the sensor is used for partial discharge of transformer and partial discharge of GIS Discharge measurement.

2.2 Microcontroller

In the microcontroller designed in this paper, the microcontroller with low external clock frequency can effectively reduce the noise and improve the anti-interference ability of the system. For square wave and sine wave with the same frequency, the high-frequency component of square wave is much more than sine wave. The amplitude of the high-frequency component of the square wave is smaller than that of the fundamental wave, but the higher the frequency, the easier it is to be emitted and become a noise source. The most influential high-frequency noise generated by the microcontroller is about three times the clock frequency. Therefore, the lower the frequency of the selected microcontroller, the lower the frequency of its three times, and the lower the probability of developing into a noise source. In addition, decoupling design and shielding technology are added to this system. Reasonable decoupling design can filter the electromagnetic interference caused by peak current jump and improve the anti-interference ability and reliability of the system [9]. The decoupling capacitor directly connected between the ground of the device and the power supply can reduce the power impedance and remove the high-frequency components as high as 1GHZ. When designing a printed circuit board, a decoupling capacitor should be added between the power supply and ground of each integrated circuit. The decoupling capacitor has two functions: on the one hand, the energy storage capacitor of the integrated circuit provides and absorbs the charge and discharge energy at the moment of opening and closing the door of the integrated circuit; On the other hand, the high-frequency noise of the device is bypassed. Shielding is an effective anti-interference measure, which can reduce the outward or inward penetration of electromagnetic field. It is often used to isolate and attenuate radiated interference. Shielding technology divides space into two regions through metal objects. Its purpose is to control the diffusion of electric field from one region to another. Shielding technology can be divided into electrostatic shielding, magnetic shielding and electromagnetic shielding. The function of electrostatic shielding is to eliminate the electromagnetic interference caused by distributed capacitance coupling between two circuits. Magnetic shielding is used to prevent the interference of low-frequency magnetic field. The high-voltage switchgear is mainly interfered by high-frequency electromagnetic field, so electromagnetic shielding is adopted, which can suppress the interference of electric field and magnetic field at the same time and prevent electromagnetic wave from entering. The sensor probe is placed in a shielding body made of low resistance metal material aluminum, and the shielding metal is used to absorb and reflect the electromagnetic field to achieve the purpose of shielding, The shielding technology is shown in Fig. 1:

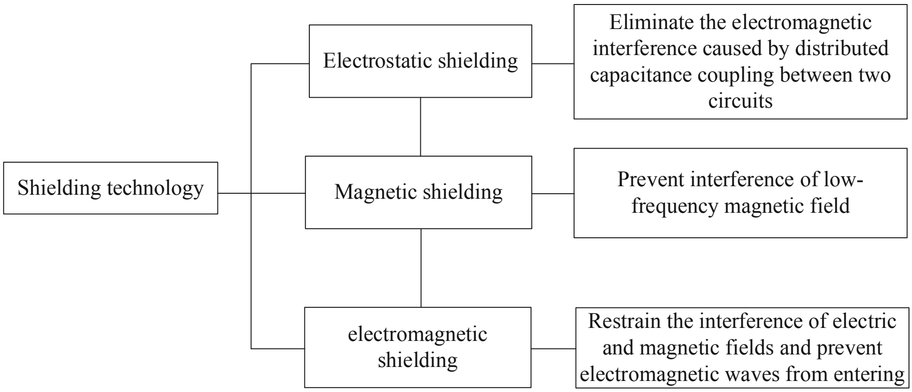

Fig. 1. Structure diagram of shielding technology

The microcontroller is mainly manufactured by high-speed CMOS technology. The static input current at the signal input end is about 1mA and the input capacitance is about 10pF. The output end of high-speed CMOS circuit has considerable load capacity, that is, considerable output value. If the output end of a gate is led to the input end with high input impedance through a long line, the reflection problem is very serious, which will cause signal distortion and increase system noise. When Tpd is greater than Tr (standard delay time), it becomes a transmission line problem. Problems such as signal reflection and impedance matching must be considered. The delay time of the signal on the printed circuit board is related to the impedance characteristics of the lead, that is, to the dielectric constant of the printed circuit board material. It can be roughly considered that the transmission speed of the signal on the lead of the printed board is about 1/3 to 1/2 of the speed of light. The tr of common logic circuit elements in the system composed of microcontroller is between 3-18ns. On the printed circuit board, the signal passes through a 7 W resistor and a 25 cm long lead, and the on-line delay time is about 4-20 ns. In other words, the lead of the signal on the printed circuit is very short, no more than 25 cm. And the number of vias is small. The rise time of the signal is faster than the signal delay time. The impedance of the transmission line is matched. For the signal transmission between the integrated blocks on the brush circuit board, Td > Trd will not occur. The wiring on the printed board shall make the wiring between circuits as short as possible under possible conditions, which will greatly reduce the interference caused by wiring.

The microcontroller manufactured by CMOS process has high input impedance, high noise and high noise tolerance. Even if the digital circuit is superimposed with 100–200 mv noise, its work will not be affected. If the printed circuit board is a four layer board, one of which is a large area of ground, or a double-sided board, and the reverse side of the signal line is a large area of ground, the cross interference between signals will become smaller. The characteristic impedance of the signal line is reduced in a large area, and the reflection of the signal at the D end is greatly reduced, which also reduces the cross interference between the signal lines.

3 Software Design

3.1 Analyze the Functional Requirements of the Online Monitoring System

Network transmission monitoring condition monitoring and fault diagnosis system is an important content of smart grid construction. Network transmission monitoring condition monitoring technology is the key supporting technology to realize the construction of Smart Substation and the core content of Smart Substation construction. The network transmission monitoring status monitoring and evaluation system at the station control layer shall be able to evaluate the working status and remaining life of power equipment according to the obtained power equipment status information, adopt the comprehensive evaluation model based on multi information fusion technology, and combine the structural characteristics and parameters of equipment, operation history status records and environmental factors; Analyze, judge and predict the faults that have occurred, are occurring or may occur, clarify the nature, type, degree and cause of faults, point out the trend and consequences of fault occurrence and development, and put forward effective countermeasures to control fault development and eliminate faults, so as to avoid power equipment accidents and ensure safe, reliable and normal operation of equipment [10]. The software system of station control layer shall provide an overall solution for on-line monitoring of intelligent substation. The system can control the temperature and load of power equipment, dissolved gas in oil, micro water in oil, bushing insulation, iron core grounding current, partial discharge, auxiliary equipment (cooling fan, oil pump, gas relay, on load tap changer, etc.), SF6 gas density and micro water in circuit breaker and GIS, GIS partial discharge, action characteristics of circuit breaker, SF6 gas leakage in GIS room The insulation of current transformer and capacitive voltage transformer, coupling capacitor insulation and lightning arrester insulation shall be comprehensively monitored. The specific functional requirements are shown in Fig. 2.

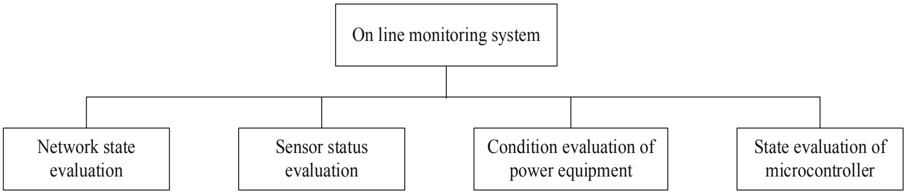

Fig. 2. System functional requirements

As shown in Fig. 2, in the system designed in this paper, its functional requirements are set as power equipment status evaluation, sensor status evaluation, network status evaluation, microcontroller status evaluation, etc. With the rapid development of intelligent substation and the wide application of computer technology in substation system in recent years, the original closure of substation system has been broken. The communication security of intelligent substation and its supporting network monitoring equipment have received great attention from power industry and relevant research departments at home and abroad. In recent years, the communication network between intelligent electronic devices in substations has become more and more perfect. The monitoring equipment grasps the operation of intelligent substations by capturing and analyzing the communication messages between substation networks, and timely finds problems, locates the root causes of faults and solves problems through efficient and reliable diagnosis algorithms, so as to avoid malignant power accidents, Ensure the safe and stable operation of power grid.

3.2 Data Acquisition Module for Establishing Power Optical Fiber Transmission Network Based on Internet of Things

The Internet of things is an important part of the new generation of information technology. The English name of the Internet of things is "the Internet of things". As the name suggests, the Internet of things is "the Internet connected with things" [11]. It mainly has two meanings: (1) the foundation and core of Internet of things technology is still the Internet, which is a network extended and expanded on the basis of the Internet; (2) Its client extends to the information exchange and communication between any object. Therefore, the definition of Internet of things is to connect any object with the Internet according to the agreed protocol through information sensing equipment such as radio frequency identification, infrared sensor, global positioning system and laser scanner, so as to realize the intelligent identification and positioning of objects Simultaneous interpreting, monitoring and managing a network [12]. With the development of sensor technology and network communication technology, the definition of the Internet of things will also be deepened. The Internet of things has distinct characteristics compared with the traditional Internet: it widely uses various sensing technologies. The Internet of things has deployed massive different kinds of sensors, each sensor is an information source. Data is real-time [13]. It collects environmental information periodically according to a certain frequency and constantly updates data. It is a network based on the Internet. The important foundation and core of Internet of things technology is still the Internet. It is an extension and expansion based on the Internet. Through the integration of various wired and wireless networks with the Internet, the information of objects can be transmitted in real time and accurately. Internet of things It not only provides the connection of sensors, but also has the ability of intelligent processing and intelligent control of objects.Analyze, process and process meaningful data from the massive information obtained by sensors, so as to meet the different needs of different users and find new application fields and application modes. Therefore, this paper uses the Internet of things to design the data acquisition module of power network. Firstly, the operating power η of power grid equipment is calculated:

$$\eta = 1 - \left(\frac{\cos \Phi_1}{\cos \Phi_2} \right)^2 \tag{1}$$

In formula (1), η is the operating power of power grid equipment; $\cos \Phi_1$ and $\cos \Phi_2$ are the power factors of power grid equipment and distribution equipment respectively. Considering the target node of power grid monitoring, the system monitoring design equation is as follows:

$$P_i = \prod_{n=1}^{K} \alpha_n \tag{2}$$

In formula (2), P_i represents the monitoring results from the monitoring source node to the destination node; K represents the total number of monitoring nodes; α_n represents the monitoring probability of node n. The collection formula of network monitoring status is as follows:

$$a_{1k} = \frac{d_k}{d_1 + d_2 + \ldots + d_N} \tag{3}$$

In formula (3), a_{1k} is the network monitoring status; d_1 is the acquisition node corresponding to error free state 1; d_2 is the acquisition node corresponding to error free state 2 d_N is the acquisition node corresponding to the error free state d_k; k is the acquisition node corresponding to the burst state. The online monitoring data after using the Internet of things technology are:

$$P(X_i|\pi(X_i)) = P(X_i|X_1, X_2, \cdots, X_{i-1}) \tag{4}$$

In formula (4), X_i is the online monitoring power grid data, and the online monitoring data node related to X_i is recorded as $\pi(X_i)$. The collected pseudo-random monitoring data are as follows:

$$X_{n+1} = \lambda X_n (1 - X_n) \tag{5}$$

In formula (5), $0 \leq \lambda \leq 4$ and λ are random monitoring parameters; X_{n+1} is pseudo-random monitoring data; X_n is the random sequence of power grid monitoring of the Internet of things. After multiple iterations, X_n is transformed into pseudo-random sequence S_n The conversion formula is as follows:

$$S_n = f(X_n) \tag{6}$$

In formula (6), S_n is a pseudo-random sequence; Where f is the random function of pseudo-random sequence.

$$\overline{x} = \mathrm{a}(y - x) \tag{7}$$

$$\overline{y} = -xz + cy + (c - a) \tag{8}$$

$$\overline{z} = xy - bz \tag{9}$$

In formulas (7) to (9), $\overline{x}$, $\overline{y}$ and $\overline{z}$ are on-line monitoring coefficients; a, b and c are acquisition parameters; x, y and z are the spatial coordinate coefficients of $\overline{x}$, $\overline{y}$ and $\overline{z}$. The monitoring sequence of power optical fiber transmission network at this time is calculated as follows:

$$F = \frac{\left(\sum_{i=1}^{52} K[i] * 2^{i=1}\right)}{2^{52}} \tag{10}$$

In formula (10), F is the initial information of the system; $K[i]$ is the i monitoring data in 256 bit random sequence;Firstly, this paper can query the monitoring equipment status of the power grid, and display and set various status parameters in the monitoring parameter setting interface, including monitoring mode, number of monitoring lines, monitoring wavelength of each monitoring optical path, monitoring threshold value, and Jianli line working channel of manual monitoring mode. Secondly, the monitoring equipment can be initialized and the monitoring mode parameters can be set. In the automatic monitoring mode, the monitoring optical power threshold and monitoring wavelength of each detection optical path can be set. In the manual monitoring mode, the detection wavelength and working channel of Jianli line can be set. Finally, connect the optical tail fiber on the hardware equipment, select the monitoring line from the existing line list, automatically set the line monitoring wavelength parameters, store the line parameter information in the database, and monitor the multi-channel working optical fiber in real time according to the set threshold value. The system can manually disconnect the pigtail connection according to the illumination power threshold, or manually reduce the optical power of optical input, so as to realize the low threshold of optical power and automatically display the line status in the line monitoring status area of the main interface.

3.3 Realization of System Software Functions

In order to realize the system software function, this paper designs the monitoring data model of power optical fiber transmission network under the above environment, as shown in Table 1.

Table 1. Model table of system monitoring data

Parameter name	Parameter code	Character type
Monitored identification	LinkedDevice	character
Monitoring device	Device Code	character
Monitoring time	AcquisitionTime	date
System transmission volume	DischarageCapacity	character
Transmission location	Discharge Position	number
Number of pulses	Pulse Count	number
Transmission microwave	DischargeWaveform	Binary stream

As shown in Table 1, according to the database file, the optical fiber line, landmark information and the fault information of test analysis are corresponding, and the fault detection conclusion is displayed in the form of simple landmark map, that is, the section type of fault, accurate fault location, section landmark number, distance from front and rear landmarks, maintenance suggestions and other information. It can assign the line number, default wavelength and IOR parameter value to the newly added optical fiber line, and store the filled information in the database; It can update the parameter information of existing lines; Lines with landmark information cannot be deleted. It can add line landmark information to the existing optical fiber line, including the line number, landmark name, landmark type, landmark location, in reservation and out reservation of the landmark. It can automatically assign a new landmark number, support the addition of a new landmark before the existing landmark location, and realize the automatic calculation and update of the subsequent landmark location, The newly added landmarks can be correctly displayed in the landmark map: the line landmark information of existing optical fiber lines can be updated, including landmark name, landmark type, in reservation and out reservation. For the updated reserved landmarks, one can realize the automatic calculation and updating of subsequent landmark positions, The updated landmarks can be correctly displayed in the landmark map: the line landmark information of existing optical fiber lines can be deleted, and the reservation can be input and output according to the deleted landmarks, so as to realize the automatic calculation and update of subsequent landmark positions.

The detection event display can be realized, including the geographic location of the event, event type, event point loss, event point interval loss and other information. The test result curve can be displayed correctly, and the test curve can be enlarged and reduced arbitrarily; It can accurately locate on the detection curve and display the accurate position (accurate to m) and loss of the positioning point. The function of querying fault detection history can be realized according to single conditions. The conditions can be set as fault detection date, fault detection personnel, fault detection line name and fault handling status. The function of querying fault detection history can also be realized according to combined conditions. The conditions can be set as fault detection date, fault detection personnel The combination of fault detection line name and fault handling status. All fault detection personnel and fault handling status can be selected. According to the detection history selected by the user, the detection records can be redisplayed, including the detection result curve and event list of the detection history in the main interface, and the comprehensive fault detection conclusion interface can also be displayed.

4 System Test

In order to improve the level of automatic maintenance and management in optical fiber communication network, improve the response ability of fault handling, and facilitate the operation and monitoring of maintenance personnel, the system designed in this paper adopts intuitive interactive interface and modular design, the specific simulation environment is as follows: the graphics card and memory are igame geforce RTX 3080 Vulcan 10 g and 16 GB respectively, the main frequency processor and operating system are Intel (R) core (TM) i7-2430 m @ 2.41ghz and windows respectively, and MATLAB 2017A is selected to complete the software programming. The simulation environment is shown in Fig. 3:

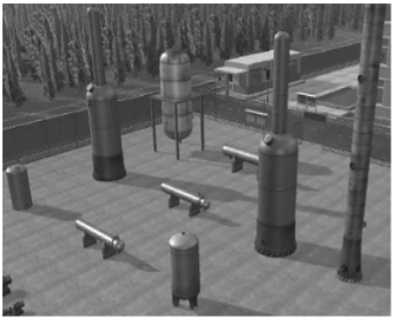

Fig. 3. Simulation experiment environment

According to the simulation experiment environment in Fig. 3 above, the experimental verification is carried out. The process and results are as follows.

4.1 Test Process

On the basis of completing the hardware and software of the dual-mode urban power optical fiber line on-line detection system, test the hardware and software of the system. The specific steps are as follows: first, use a multimeter to detect whether there is a circuit short circuit in the hardware, then power on the hardware, use a multimeter to test the power circuit voltage, and the test voltages are + 24V, + 12V, + 5V respectively, + Whether the output voltage of 3.3V and −5V circuits is normal. Based on the completion of power supply test. The software and Ethernet switching module are added to the hardware, and the software and hardware are connected according to the overall scheme of the system. The network transmission format in the system is shown in Table 2.

Table 2. Network transmission format

Frame header (HEX)	2byte
Lenth(hex)	1byte
Type(hex)	1byte
Mode(hex)	1byte
Data(hex)	nbyte
SUM(hex)	2byte

As shown in Table 2, bytes 0 and 1 are fixed data frame headers. Oxee starts with 0x55. The second byte (lenth) is the frame length. The third byte (type) is the function definition byte. The 4th byte (mode) is the working mode. The 5th to 4th + nth bytes (data) are the corresponding function parameters. The S + N and 6 + n bytes (sum) are checksum, overflow and discard the high bit. At this time, the normal operation of the hardware and software of the system can be guaranteed.

4.2 Test Results and Discussion

Under the above experimental environment, the system designed in this paper is compared with the traditional OTD online monitoring system. The experimental results are shown in Table 3.

Table 3. Experimental results

Number of experiments	Network monitoring time of traditional OTD online monitoring system / MS	The network of the system designed in this paperMonitoring time / MS
1	30	10
2	35	11
3	32	08
4	36	12

As shown in Table 3, the traditional OTD online monitoring system has a long network monitoring time, which directly affects the transmission effect of network data; The online monitoring system designed in this paper has shorter network monitoring time and better network data transmission effect, which is in line with the purpose of this paper.

In order to further verify the effectiveness of the method in this paper, the risk prediction of comprehensive intelligent training simulation of power communication transmission network is carried out, and the convergence curve of prediction output is obtained, as shown in Fig. 4.

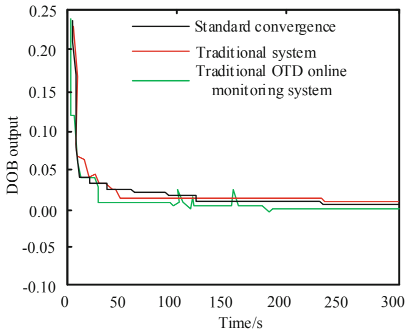

Fig. 4. Convergence curve of risk prediction of integrated intelligent training simulation for power communication transmission network

According to the analysis of Fig. 4, the convergence of risk prediction of comprehensive intelligent training simulation of power communication transmission network by this system is consistent with the actual convergence effect, while the convergence of risk prediction of comprehensive intelligent training simulation of power communication transmission network by traditional OTD online monitoring system is quite different from the actual convergence effect, It shows that the risk prediction effect of the system in this paper is better than that of the comprehensive intelligent training simulation of the power communication transmission network of the traditional system.

To sum up, the designed system has good performance.

5 Conclusion

This paper analyzes the current situation of on-line monitoring of power optical fiber transmission network, and completes the demand analysis of on-line monitoring system of power optical fiber transmission network based on Internet of things. The equipment environment in the substation is complex. How to avoid the interference factors in the substation is the key in the practical application of the scheme. This paper analyzes the interference sources and gives the corresponding network structure design to avoid interference. The on-line monitoring system of intelligent substation based on Internet of things is programmed. Although there is some research on on-line monitoring of power optical fiber transmission network based on Internet of things, it still faces many difficulties in practical application and has not been applied in practice. The next research work needs to fully consider the interference of electromagnetic signals in the substation and carry out anti-interference design through the actual operation in the substation. It is also necessary to optimize the software interface to further expand the functions.

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