*Research Article*

# Analysis on Network Information Security Protection Technology of Intelligent Terminal Power Monitoring System of Substation under the Support of Multimodal Multimedia Information

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According to the perspective of multimode multimedia data, the protection technology of network information security is mainly discussed. The theoretical basic research is outlined, its meaning, level, reasons, and consequences are expounded, and the future research content and development trend are discussed. With the rapid development of online services and mobile technology, the world has entered the era of multimedia big data. There have been a large number of scientific studies in the multimedia industry, which explain the various fields of big data, including the capture, storage, reference, excavation, and search of multimedia big data. The article expounds the specific concept of power monitoring system network information security, establishes the safety regulations of electric power monitoring system, formulates the corresponding ideas for the safety guarantee level of electric power monitoring system, and promotes the long-term development of China's electric power enterprises. The safe operation of the power monitoring system is directly related to the stable operation of all power supply systems and even the social economy. At this stage, the situation of network security management in China's power monitoring system is still not optimistic. We take the multimode multimedia data, organize the research dynamics of the network security protection technology, and discuss the future research trend.

## 1. Introduction

In recent years, with the development of power engineering technology, the establishment of smart grid continues to be promoted, and electronic computers and related Internet technology are gradually popularized in the application field of power substation. However, the information security problem in productization is becoming increasingly prominent. In order to facilitate ensuring the information security of smart substation, through detailed analysis from the safety of smart substation itself, operation and maintenance security, active defense system, and information security assessment, a series of technical improvement of information security of smart substation is given. Compared with the tradition, the multimodal multimedia has the

characteristics of a rapid sense of smell, which can reflect the information sensitivity in a certain range and spread the information quickly. In the organizational behavior experiment, the comments on the effect of multimode multimedia communication are mostly based on multimedia richness. Substation is the main support point of smart grid, and it is the operation data collection source and command execution unit of power grid. It is closely combined with other stages and is an important means to unify the security, high quality, and economic situation of smart grid, and it is an important reflection of promoting the characteristics of smart grid automation technology. Substation intelligent auxiliary video monitoring system can provide safety protection, environmental protection monitoring, auxiliary control, and other services, make the substation operation

more reliable, and become a part of the main support point of smart substation. How to give full play to the comprehensive development potential of the current supporting facilities, maximize the logistics efficiency, and improve the system security has become an urgent problem in substation management. The rapid development of computer communication technology and automation control has laid the foundation for the development trend of automation in China. The most obvious thing is the upgrade of power supply system design technology, and the smart grid was born accordingly. The establishment of the smart grid involves all aspects of the power grid structure, in which the substation, as one of the most important structures of the power grid, plays an irreplaceable role in the transmission and distribution, distribution equipment, and other links of the power supply system. To some extent, the establishment of smart grid can be understood as the establishment of smart substation.

## 2. Definition of Multimode

Modality refers to the special way or origin in which people and machines and equipment receive information, including touch, taste buds, and visual olfactory nerve. Compared with traditional shopping things, online products do not have the characteristics of immediate dissemination to others, and the display of online products can change customers' reflection to a certain extent. In the behavior experiment of marketing organization behavior, the comments on the effect of multimode multimedia communication are mostly based on multimedia richness as the carrier. The effect of information dissemination varies according to the way, with the application of sound frequency, short video, text, and other news media [1] in the sensor, radar detection, acceleration sensor, infrared sensor, and other facilities. Because multimedia data include usually the media of all kinds of information, multimodal learning has become an important way to analyze and understand the specific content of the multimedia system. Figure 1 shows the configuration method, device, system, and intelligent terminal and process of a monitoring apparatus.

### 2.1. Important Research Orientation of Information Learning of Multimode Optical Fiber Multimedia System.
Multimodal learning is divided into the following five research directions.

Multimodal representation learning: it mainly studies how to convert the Semantic information contained in multiple modal data into real value vectors. Modal mapping mainly studies how to map the information mapping in a specific modal data to another modal. Alignment mainly studies how to identify the corresponding relationships between components and elements of different modalities. Multimodal fusion mainly studies how to integrate models and features between different modalities.

Collaborative learning: it mainly studies how to transfer the knowledge learned from the information rich mode to the information deficient mode, so that the learning of each
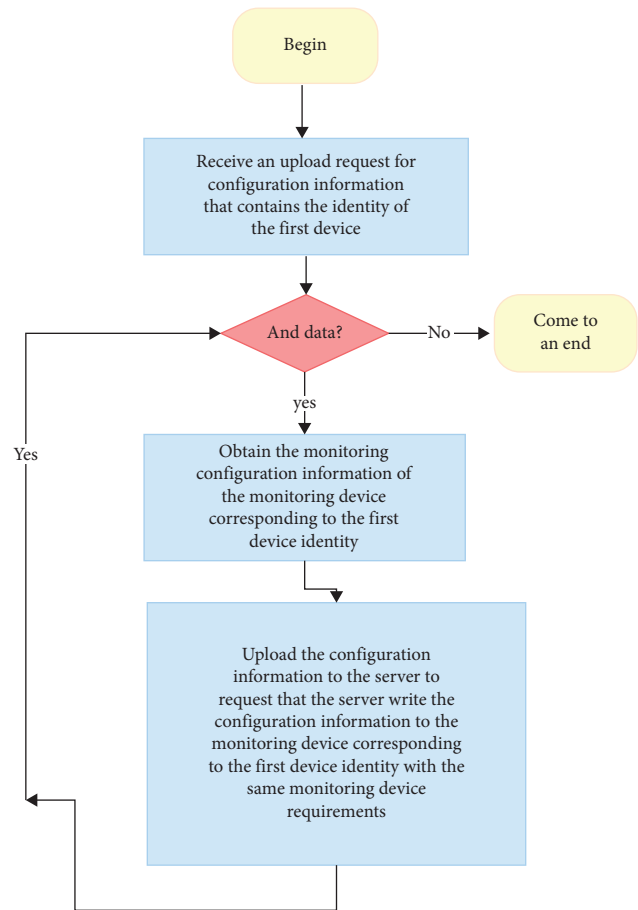


FIGURE 1: Configuration method, device, system, and intelligent terminal and process of a monitoring device.

mode can assist each other. Typical methods include multimodal zero sample learning and domain adaptation. In collaborative learning key studies, they generally retrieve and read a wide variety of data on online knowledge learning. You must reduce the variability and abstraction through multimodal multimedia information resource management. The most typical ways are multimodal zero-like version learning, domain adaptation, and others [2]. Figure 2 shows China's electricity consumption forecast trend chart for the period 2016–2022.

### 2.2. Multimodal Multimedia Information Representation and Learning.
The purpose of representation learning is to abstract the meaning information often involved in the research topics (data storage structure, image, short video, video, voice, text, etc.) and convert it into real-number-space vectors. Only the multimedia system to promote and process the information is applicable to the audience community. Multimedia system information can solve the fuzzy test and reach an agreement quickly through the cognition of information representation and learning in multimodal multimedia. When several multiforms coexist, the characteristics of the subject to be studied must be acquired at the same time from the various isoform information sources. In unimodal                representation                learning,                polymodal
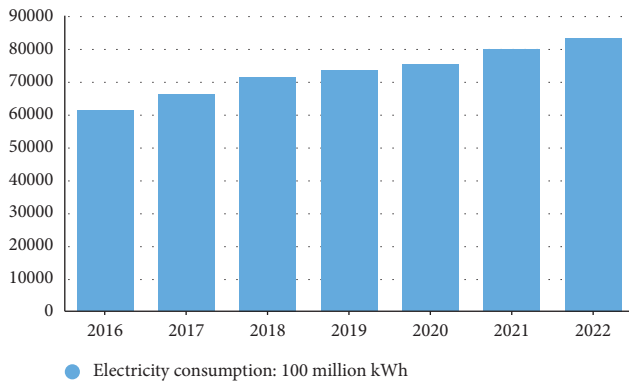
FIGURE 2: China's electricity consumption forecast trend chart for the period 2016–2022.

representation learning should consider the consistency and diversity of polymodal information. The biggest problem to express this is the loss of information [3]. The purpose of expression is to better serve the middle and downstream daily tasks, but it is difficult to fully store all the information after expression, which is generally closely related to the middle and downstream daily tasks. Below, for a description of the expression, we obtain the expression. This expression is likely to be very good, but it is very difficult to express every level or several dimensions. As shown in Figure 3, the substation monitors the proportion of the main voltage level.

It shows that it should have smooth, time consistency, sparsity, and of course clustering characteristics. It shows that the similarity in the space should reflect the similarity of the corresponding theory. Even in the lack of some pattern data information, it is very easy to get such multiple patterns to indicate the information needed [4]. After giving the information of other observation modes, the missing mode data information must be adjusted. Figure 4 shows a technical scheme for a power grid monitoring terminal system for situational awareness.

Multimodal expression mainly includes two research contents: express together and coexpress together.

(1) *Synergy Representation.* This means projecting several multiforms of information together into a unified multimodal linear space.

(2) *Collaborative Representation.* Collaboration shows the responsibility of projecting multimode fibers into your representation space, but the projected spatial vector reaches a certain correlation bundle, such as linear relationships.

*Application.* Apply the deep Boltzmann equipment to conduct multimodal learning training.

It is explicitly proposed to extend the deep Boltzmann (DBM) construction to the multimodal industry and to train the multimodal joint probability distribution according to the multimodal DBM learning. Learn the joint probability distribution p from the two DBMs of image and text. In use, images can be keyed in with standard probability p-form text features to obtain text narratives corresponding to the images; You can also type text and form image features based on the probability of applicability [5]. Based on the two major image cases that are close to the eigenvalue of the matrix, the image matching the text description can be obtained. Figure 5 shows a network information security instance.

*Main Use.* Use multimode fiber nervous system language model to unify visual effect meaning.

The eigenvalues of the matrix learned by small groups are used to achieve the characteristics of addition and subtraction operation, and the image with "specific transformation semantics" can also be retrieved in the given image. Compared with other ways of multimedia systems, multimedia data are easier to conduct group cooperation to achieve the target user requirements. For other targets such as retrieval, the searchers are used to reduce the attention due to the establishment of the target, so as to achieve the "specific transformation of semantics," so that the target users can meet the requirements and lack of attention to the indoor space.

## 3. Security Prevention and Analysis of Electric Power Monitoring System under Multimedia Data

The security prevention of the power monitoring system is mainly aimed at the application system and the production control system according to the Internet. The security goal is to ensure the security of the power monitoring system and the production dispatching mobile data network from the destruction and attack of network hackers, viruses, malicious programs, and other attacks. This study shows that the security of multimode multimedia information of the power monitoring system can improve the security, and the care of the overall security goal can improve the security goal and generate a higher total flow to the power monitoring system platform. Secondly, according to the overall goal of the national security index of the monitoring system, the expression of the multimedia system information is more meaningful. To avoid the collapse or paralysis of the power monitoring system, thereby avoiding safety accidents and large-scale power outages, safety is based on the standards of "security system zoning, internet dedicated, horizontal protection, and vertical verification". The core concept of security is the "maintenance, detection, solution, repair, and review" closed-loop control system [6]. Power monitoring system security protection equipment is used to complete the power monitoring system network and information security protection of functional equipment or machine equipment [7]. For example, power system dedicated network isolator can be power dedicated cross unilateral security isolation machine equipment, power dedicated longitudinal data encryption verification machine equipment, power dedicated dial server, software and hardware network firewall, IDS/IPS, malicious program defense system, security system partition boundary, set access control strategy power production scheduling personal digital
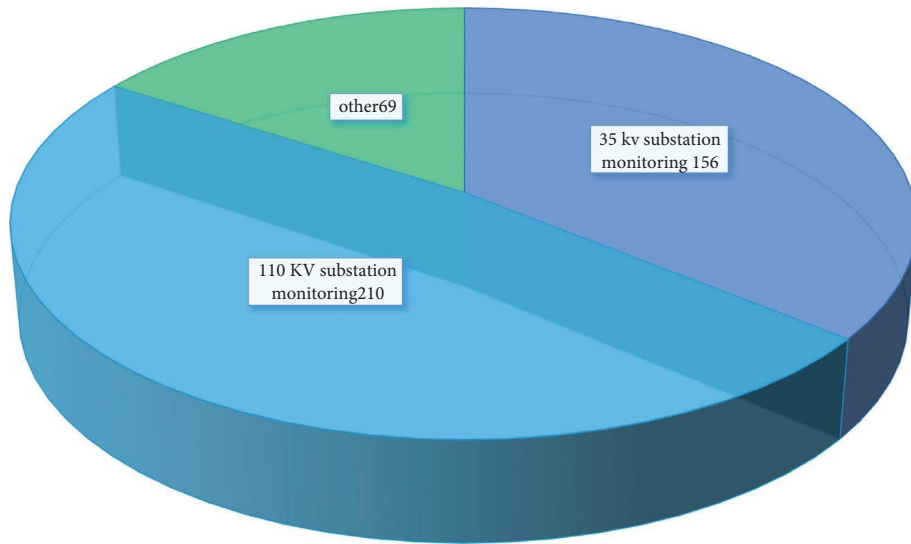
FIGURE 3: The substation monitors the proportion of the main voltage level.
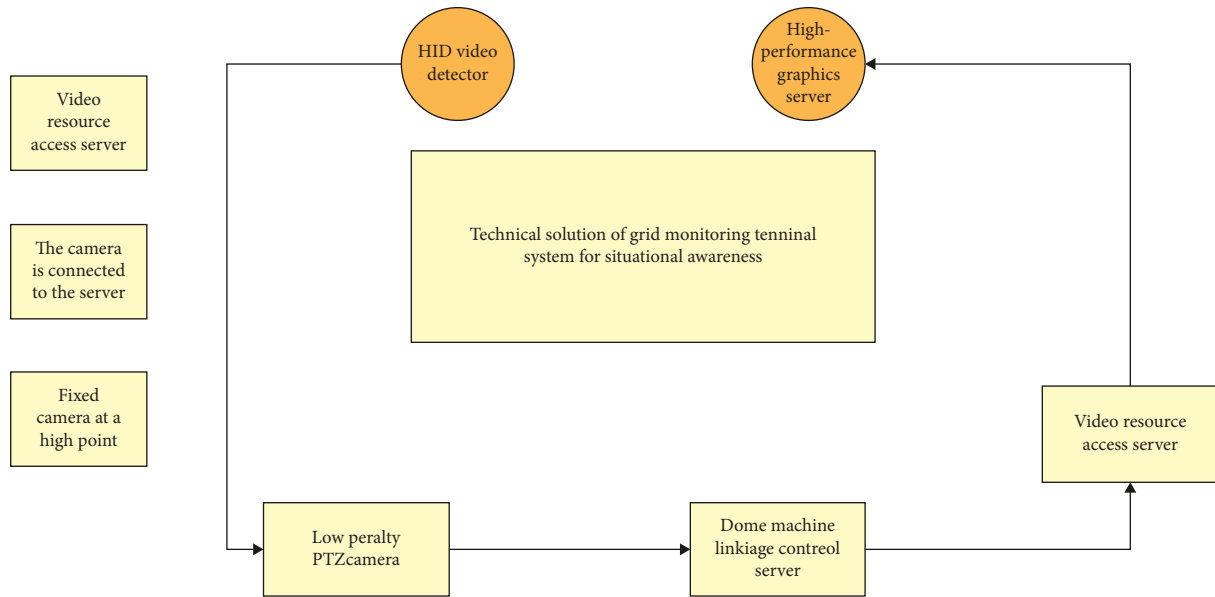


FIGURE 4: A technical solution for a power grid monitoring terminal system used for situational awareness.



FIGURE 5: Network information security example.

certificate system software, network security audit, network management, comprehensive alarm equipment, distribution network master control chip security protection equipment, distribution network terminal equipment security protection equipment, etc. Figure 6 shows the Dong Jin LOT intelligent terminal security solution.

*3.1. Security System Partition of Power Monitoring System under Multimode Optical Fiber Multimedia Data.* The view of this scientific research can provide practical guidance for the power monitoring system security platform company under multimode optical fiber multimedia data. At present, more and more distribution stations pay attention to information management and power monitoring. The power monitoring system is divided into manufacturing control area and management information area. The main production area can be divided into the control area (buffer area) and the non-control area (buffer area); in the information management area, the vertical interconnection of the safety production control area of the production control area must be connected with the same safety area to prevent the vertical cross-connection between the safety areas [8]. For small- and medium-sized distribution stations and power stations, the buffer assembly can be simplified according to the actual situation. After the simplification, the buffer zone should be protected according to the high or low standard against the vertical cross-connection of different buffers. Figure 7 shows a technical scheme for substation network monitoring system.

In the case of reducing the application of wireless communication network, many mobile data networks (non-power dispatching mobile data networks), or the virtual private networks of the external cloud computing platform, Internet, and terminal equipment for vertical connection, the secure connection area is applied.

The necessary security guarantee measures should be adopted in the regional security boundary of each region, and the universal Internet service that transcends the boundary of enterprise production and management area and management information area is strictly prohibited [9]. Figure 8 shows the production method of smart substation interval protection control.

*3.2. The Power Monitoring System Is Dedicated to the Internet.* The production control area of the power monitoring system shall adopt a separate computer equipment networking scheme through the special wireless channel and adopt different wireless channels, different light wavelengths, and different cores according to the SDH to complete the security isolation of other network communication from the external public network.

Compared with photos, text, and other multimedia information carriers, multimedia information can bring higher rate and user trust, but electric power monitoring system in practice, also considering the user's overall goal as its value, according to the user's overall goal, selectively gives the user the corresponding multimode multimedia Internet information into the manufacture and use of the monitoring system. Network communication in the manufacturing area can be further divided into logically isolated immediate subnet masks and non-immediate subnet masks [10]. The seven-layer agreement to manipulate the data communication of the manufacturing area should take corresponding safety precautions. This layer is isolated from other networks, the link layer is divided into VLAN, the transmission layer creates secure routing and virtual private network, the network layer creates data encryption tunnel construction, and the session layer adopts security authentication to indicate that the layer includes data information. Figure 9 shows the technical scheme of smart substation.

*3.3. Security Isolation and Capability Isolation in Multimode Optical Fiber Multimedia Data.* Between the enterprise production management area and the information management area, the enterprise should set the special level of unilateral safety isolation equipment through the relevant national safety inspection and certification. The isolation compressive strength can only be achieved through one-way data transmission [11]. The security area in the control area must use the network firewall and the same facilities with key management function system for logical isolation. Figure 10 shows the network security issues.

The data transmission from the production area to the information management area adopts the forward security isolation equipment, that from the supervision area that can only be unilateral data transmission to the enterprise production management area adopts the reverse direction insurance device, and only the unilateral data transmission can be used.

Line loss power $\triangle P$(kW):

$$\Delta P = 3 \, (\text{KIP}) 2 \, (Re + \text{ReT} + \text{ReI}) \times 10 - 3. \qquad (1)$$

If the accuracy requirement is not high, the temperature additional resistance ReT and the load current additional resistance ReI can be ignored.

*3.4. Vertical Certification.* The vertical connection between the production control area and the LAN should set up special power engineering vertical data encryption authentication equipment or data encryption authentication gateway IP and related equipment according to the relevant national security inspection and authentication. As shown in Figure 11, a box-type substation monitoring system is made.

Vertical data encryption authentication machine and equipment use the national landing password management unit with excellent performance of the power engineering special hardware configuration landing password module, using the power engineering special encryption algorithm, suitable for authentication, data encryption, electronic signature, and key generation and maintenance. In this paper, the multimode multimedia information richness foundation is closely combined with the research of numerical data encryption and authentication machine target science, and it is used in the relevant experiments of machine key platform to strengthen the cognition of multimedia information richness foundation. The key and encryption technology of the vertical data encryption authentication machine only exist in the secure storage area of the system password control components, which is completely isolated from the APP software system, and it cannot browse through all illegal behaviors [12]. The unique switch power supply hardware is equipped with a login password unit, and the
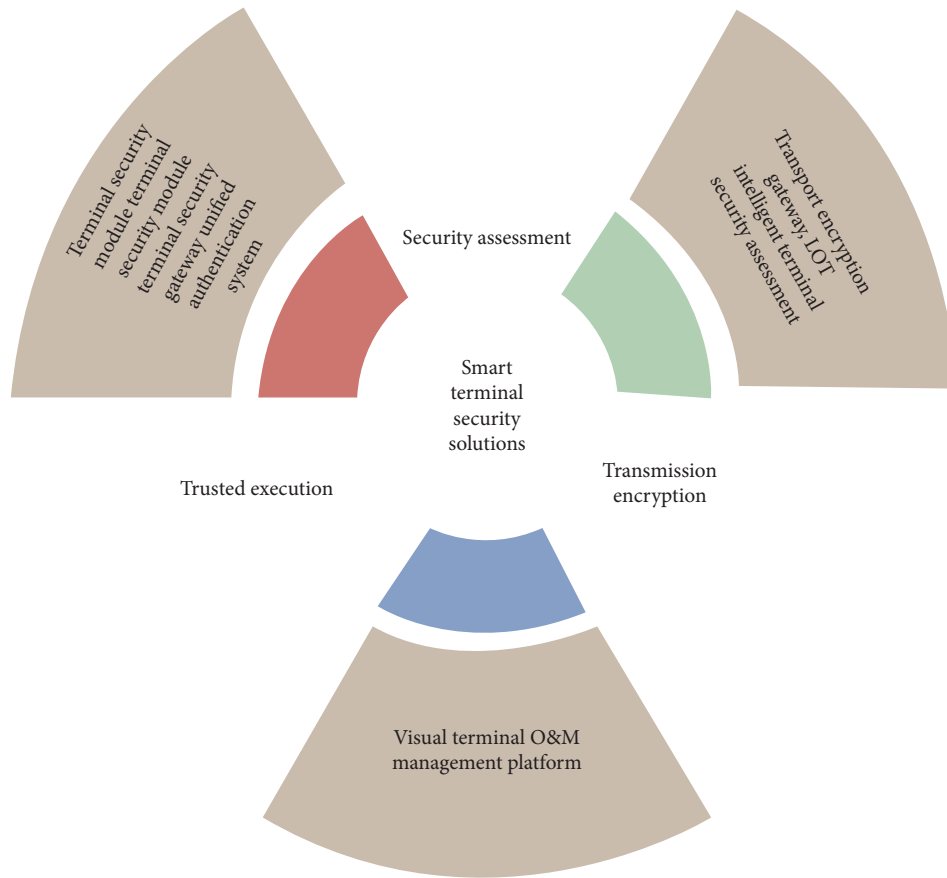
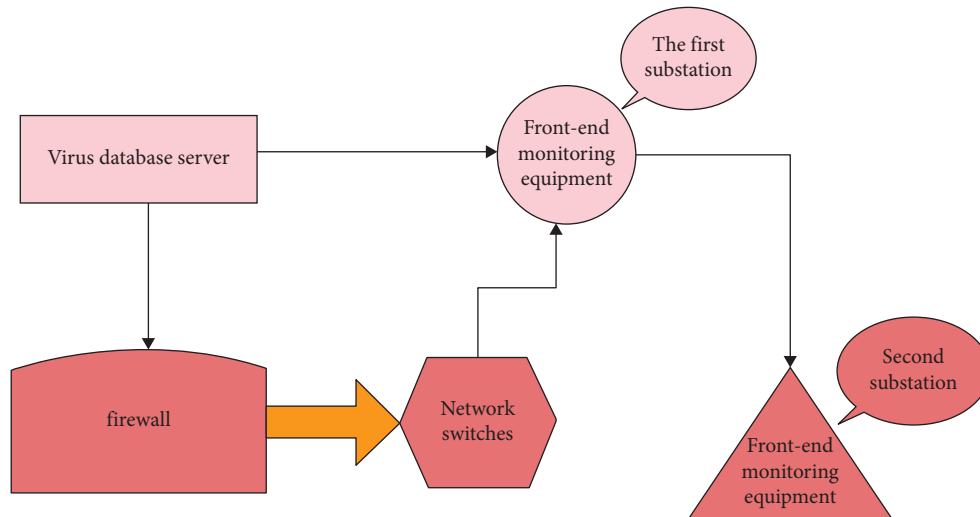FIGURE 6: Dong Jin LOT intelligent terminal security solution.



FIGURE 7: A technical scheme of the substation network monitoring system.

security compressive strength and related software and hardware characteristics are regularly evaluated by authoritative experts to ensure its security factor. Table 1 shows a method of substation monitoring information acceptance operation visualization based on source maintenance technology.
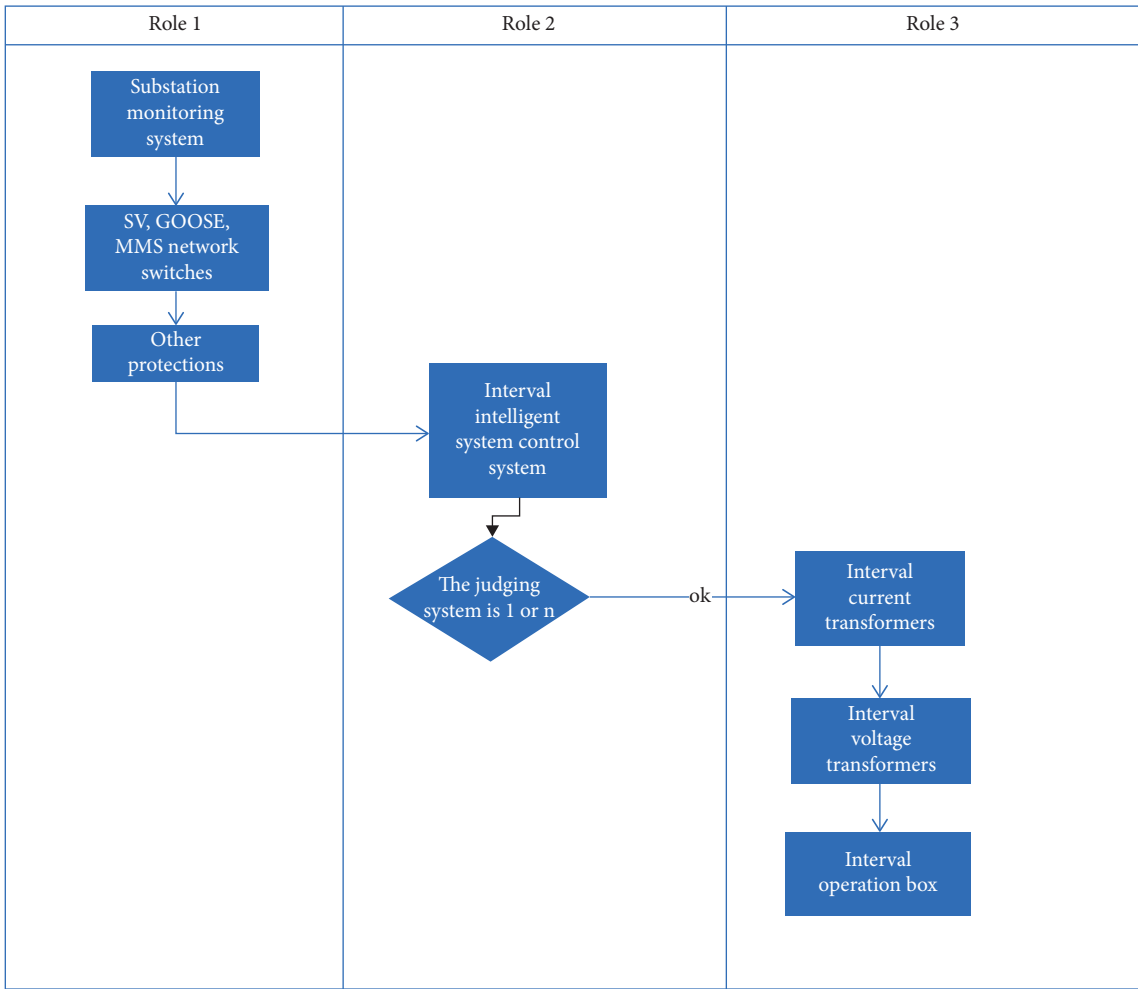
FIGURE 8: The production method of interval protection control and control of intelligent substation.
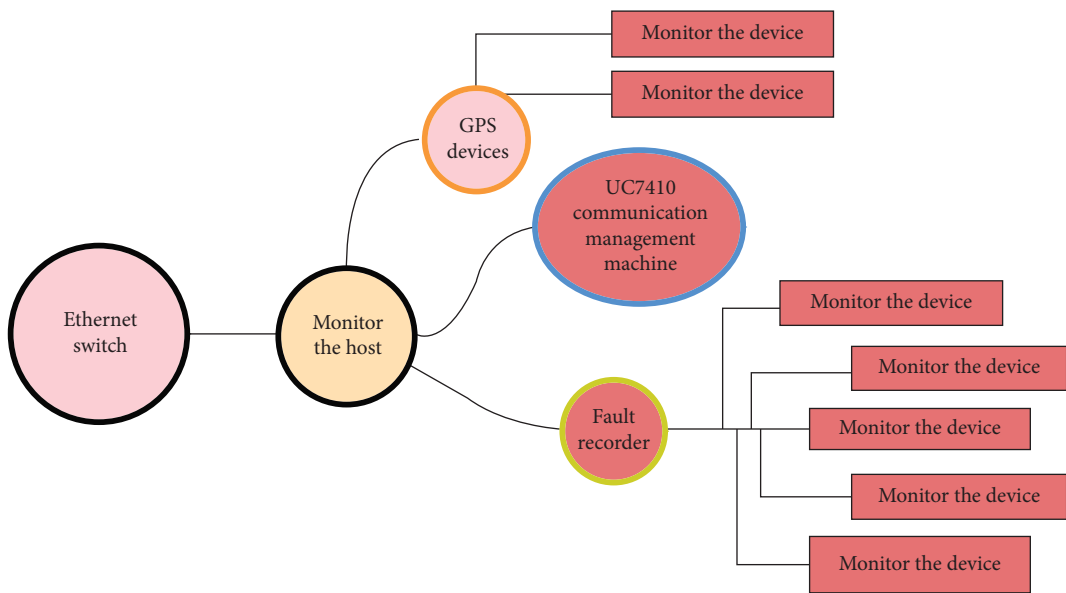


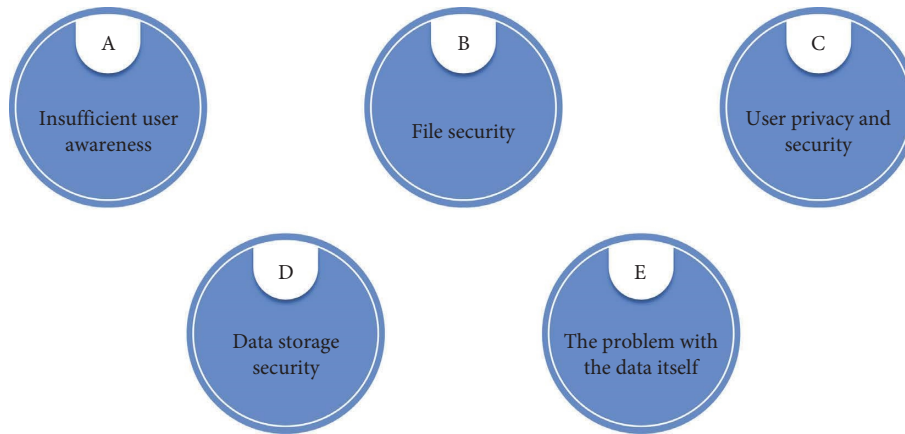FIGURE 9: Technical scheme of smart substation.
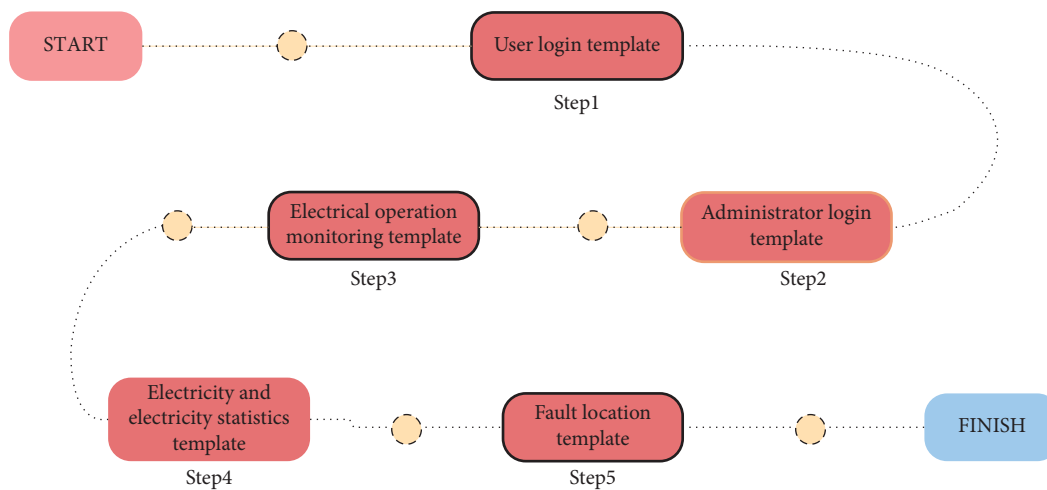
FIGURE 10: Network security issues.



FIGURE 11: Production method of a box-type substation monitoring system.

TABLE 1: A method of substation monitoring information acceptance operation visualization based on source maintenance technology.

| | |
|---|---|
| S1 | The source-side maintenance imitation Allah station establishes a network communication connection with the substation motion device and automatically reads the motion terminal information to the substation motion device through the network interface |
| S2 | The simulation scheduling system sends information retrieval instructions to the substation motion device, respectively, and the downstream control instructions are transmitted |
| S3 | The monitoring center integrates the channel information of each imitation Allah station in one interface through the master intelligent simulation server |

## 4. General Security Prevention Technology of Power Monitoring System under Multimode Optical Fiber Multimedia Data

According to the detailed regulations of the SGC "Technical Specification for Intelligent Substation", when selecting sensors for intelligent substations, factors such as information content, communication, operation, and cutting-edge intelligent technology should be considered, and real-time panoramic inspection should be completed using intelligent device parameters and standardized services as the platform. Since its inception, the distribution station needs to maintain stability, improve asset utilization, and reduce human impact to achieve the goal of safe operation of the power grid. The meaning of this goal includes stability, rationality, compatibility, subjectivity, interactivity, and flexibility, as well as technical characteristics such as device intelligence, data exchange standardization, relatively high system software integration, operation control automation technology, and harmonious maintenance and operation [13]. When planning the smart substation control network, ensuring the best performance of the Internet is the main

reference standard, but the network design scheme lacks the safety factor. Under the premise of smart substation network security risk analysis, its safety prevention requirements are analyzed, so as to introduce the creation method of smart substation protection system. The most typical security technology mainly includes firewall technology, intrusion detection technology, malicious code security protection, passive security improvement technology, grade protection evaluation, and risk evaluation technology. Table 2 shows the integrated power monitoring functions.

### 4.1. Firewall Technology of Power Monitoring System in Multimode Optical Fiber Multimedia Data.
Firewall is a network security product built between two different network virtualization products. According to the defined access control strategy, all dual data flow needs to pass through the firewall, and only the approved reasonable and legitimate data information can pass through the firewall [14]. Its main function is the key management.

In the specific cyberspace, there are two main ways of deploying a firewall. One solution is to equip the connection point of internal network and external network address with firewall, internal network and external network address router series, which is used to regularly check whether the data file to network address is guaranteed by the network server firewall in front of the network system. The other solution is to join the network convergence switch and network service switch, and incorporate the operation of network consumers into the management of network server, software systems and network client servers [15]. Table 3 shows the adaptive security protection system technology method based on computable big data information network.

### 4.2. Intrusion Detection Technology of Electric Power Monitoring System in Multimodal Multimedia Data.
Intrusion detection technology is to collect research information from several key links of the Internet or computing system to ensure that there are no security violations or attack signs in the Internet or system software. Intrusion detection technology is a dynamic detection service technology. Once a hacker attack is found, alarm messages will be sent and can be used with a firewall to block the hacker attack.

The actual line resistance is

$$R = R20 + Rt + Rt. \tag{2}$$

### 4.3. Prevention of Malicious Code of Power Monitoring System in Multimodal Multimedia Data.
The most common malicious code supply precautions include the following.

*Terminal Equipment FAQ.* Make emergency starter disks and brand-new emergency patch disks; computer applications with the original anti-malicious program must be fixed immediately for vulnerabilities.

The loss of multiple outlet lines (or only one outlet line, with multiple large branches at the exit) is calculated.

With the $m$ outgoing line, the load current of each circuit is $I1, I2, \ldots, Im$.

Total current of platform area:

$$I = I1 + I2 \ldots + Im. \tag{3}$$

The equivalent resistance per route loss is Re1, Re2, $\ldots$, Rem.

Multiline loss is calculated:

$$\begin{aligned} \Delta P &= \Delta P1 + \Delta P2 + \ldots + \Delta Pm \\ &= 3\left(I21Re1 + I22Re2 + \ldots + I2m\text{Rem}\right). \end{aligned} \tag{4}$$

If each outgoing line structure is the same,

$$\begin{aligned} I1 &= I2 = \ldots = Im, \\ Re1 &= Re2 = \ldots = \text{Rem}. \end{aligned} \tag{5}$$

*Network Server Security Protection.* Build an efficient malicious code protection system to turn off the unused port number and share the port number on the server and immediately install the hotfix process on the server by using the unknown mobile phone software or the original anti-malicious program without using the U disk.

*Internet Security Protection.* The installation and assembly of firewalls prohibit using waste network ports.

### 4.4. Passive Safety Structure Reinforcement Technology of Power Monitoring System under Multimodal Multimedia Data.
The safety factor improvement is mainly for computer equipment, computer operating system or software system, and relational database. Create a security state at the power monitoring system transmission and server layers. According to the basic theory of multimode optical fiber multimedia data research and overall objective retrieval, the experimental method is selected to discuss the passive safety structure reinforcement system technology of multimodal multimedia data. Research has shown that compared to multimedia systems such as photos and videos, secure reinforcement operations are more secure and reliable. By manually or using specific safety reinforcement tools, safety and reliability are more intelligently ensured during safety reinforcement operations [16]. The basic requirement of improving the security of the power monitoring system is to open to the public the minimum service, set the minimum management authority, and improve more financial audits. The line current is $I$, line resistance is $R$, line resistance is $X$, the voltage at the beginning and end of the line is $U1$ and $U2$, respectively, and the power factor of the load is cos.
Loss of voltage:

$$\Delta U = \Delta U1 - \Delta U2. \tag{7}$$

### 4.5. Power Monitoring System Level Maintenance and Assessment and Risk Assessment in Multimodal Multimedia System Information.
The grade protection evaluation and evaluation of the power monitoring system is the theme

TABLE 2: Function of integrated power monitoring.

| Telemetry, telecommunications, remote control, and other functions | Relay protection | Power quality management functions |
|---|---|---|
| Tunnel traffic monitoring function | Energy management functions | Distribution automation functions |
| Secondary management feature | Substation environmental monitoring | Lighting and ventilation control functions |

TABLE 3: The technical method of adaptive security protection system based on computable big data information network.

| 1 | Trust-based dataset storage module |
|---|---|
| 2 | Trust-based data transfer module |
| 3 | Risk analysis feedback module |
| 4 | Risk monitoring module |
| 5 | Risk assessment module |
| 6 | Security defense module |
| 7 | Alert module |

activity of testing and evaluating the grade protection evaluation of the power monitoring system according to the relevant rules, regulations, and standards and norms of the state and the power enterprises. Risk assessment is protected by information security level, and the relevant theme activities of risk assessment are included in the different stages of security level protection identification of electric power monitoring system [17].

## 5. Overall Solution of Substation Intelligent Auxiliary Supervision

The platform is based on the substation intelligent auxiliary monitoring and management platform to complete the information collection and the overall planning role of the station end. Video surveillance system includes basic video supervision, intelligent video monitoring, and infrared thermal imager supervision. Dynamic ring detection system is based on the intelligent socket equipment and can collect the information of environmental protection monitoring, intelligent security, fire alarm system, intelligent control system, access control system, and other subsystems [18].

*5.1. Real-Time Detection.* Choose high-quality surveillance camera, with anti-pollution, moisture-proof, and other functions. Immediately obtain clear monitoring images in the monitoring area. Different kinds of comprehensive surveillance cameras can meet the regulatory market demand of each kind of local monitoring equipment, establishing 24 hours of uninterrupted supervision. In addition, it can also carry out the actual operation of a Yuntai device, adjust the angle, direction, and lens focal length, and complete the multidirectional, multiangle, and 360-degree all-day supervision.

*5.2. Videos and Retrieval.* The previous digital audio is applicable to the quick query according to the intelligent monitoring, which connects the event to the video control part to store data to meet the storage market demand after the evidence investigation; the previous video search is according to the regional intrusion and cross detection. You can set your own intelligent standards, to ensure quick query in the broadcast video link. Video search is available for choice [19].

*5.3. Data Analysis System.* The equipment status in the substation is observed through intelligent image detection and structured analysis, and the instrument panel reading

value, disconnector status, intermittent circuit breaker power switch indicator status and control box marking status are identified [20]. If the copy exceeds the limit, warning can be issued, and the identification conclusion can be uploaded to the information integration platform through the DL/T860 agreement.

## 6. Conclusion

This study describes the application analysis of multimodal multimedia data. In this paper, the rich and colorful multimedia data are combined with the target research of the power distribution station and the monitoring system, and they are used in the relevant research of the supervision system platform to deepen the cognition of the multimedia information richness. The substation distribution monitoring system is dominated by electronic information technology, data communication, and resource sharing. The implementation of the video monitoring system of substation automation technology also plays a decisive role in the safe and stable operation of the system, the quality and quality of power supply, and the reduction of maintenance costs. However, there are many problems such as Internet, communication, interference signal, and system stability in the specific application. With the comprehensive operation in the future, there will be an uncommon phenomenon, waiting for analysis and processing. This requires people to improve the operation and maintenance of personnel and monitoring system equipment in daily work, so that the necessity of supervising the maintenance and management of the equipment is the same as the maintenance and management of all power distribution equipment in the substation. In particular, the management method of remote real-time monitoring machine should be strengthened. Supervision plays an important role in the operation and management of equipment. We are committed to discussing the construction of a bridge between multimedia test and big data solutions within the original framework of big data technology. Its application in multimedia analysis, the current advantages and limitations of the current way, and the hidden future direction of multimedia data analysis are discussed. In general, the network information security of smart substation in the smart grid is related to the development of smart substation. Promoting the establishment of smart substation network communication is beneficial to the development of smart substation and completing the high-speed, safe, and reliable development of smart grid, so as to achieve China's social and economic development of high efficiency, stability, and long-term sustainability. There are also some drawbacks in this study. First, the presentation is the application and monitoring system in the intelligent terminal. Future research can choose more product categories and even the differences in happy functional new products. Second, we have paid attention to the difference between multimedia information and intelligent terminals and whether the multimedia information is similar to the intelligent terminal power monitoring system. Multimode multimedia system information can be expressed in advertising, professional knowledge information, and other

more ways, which has not been considered in the article. In future studies, the monitoring safety design can be further improved. In the future, it can be further analyzed and discussed in this aspect.

## Data Availability

The labeled dataset used to support the findings of this study is available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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