CYG长园 股票代码 600525.SH Stock Code

CYG Integrated Intelligence Management and Control System

CYG SUNRI CO., LTD.

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目 录

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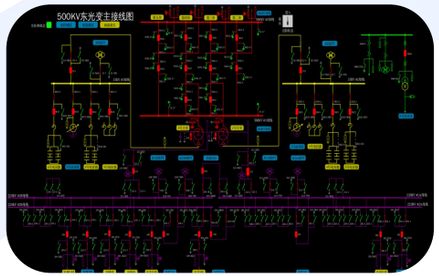
PART 01

Background

With the continuous expansion of the scale of power grid equipment, the contradiction between the continuous growth of production equipment and the insufficient allocation of operation and maintenance personnel is becoming increasingly prominent

The substation is located in a remote area, and manual operation and maintenance are time-consuming and laborious

Equipment surge, high workload and long time for manual operation and maintenance



The independent design of each subsystem of auxiliary equipment makes information fusion difficult, resulting in information silos

Manual operation and maintenance heavily rely on personal experience, making it difficult to ensure service quality

Risk identification relies on regular verification, with information delay and poor timeliness

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Objective

Core

Real time monitoring
intelligent inspection
automatic recognition
intelligent linkage

Research

Comprehensive perception
Machine inspection
Intelligent linkage
Intelligent Warning

construction

HD video
robot
drone
mobile operation

Optimization

Inspection Efficiency
Inspection Quality
Inspection Cost

People->machine

PART 02

Product

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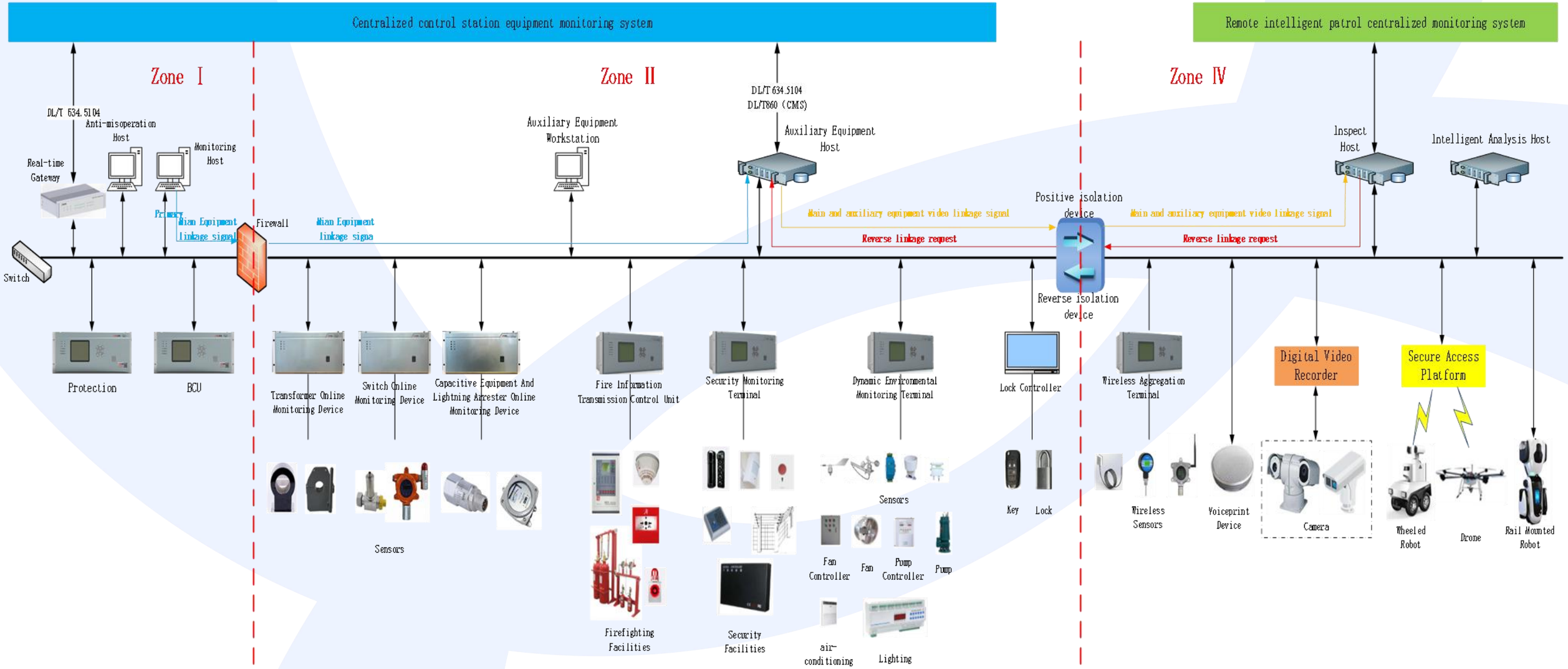
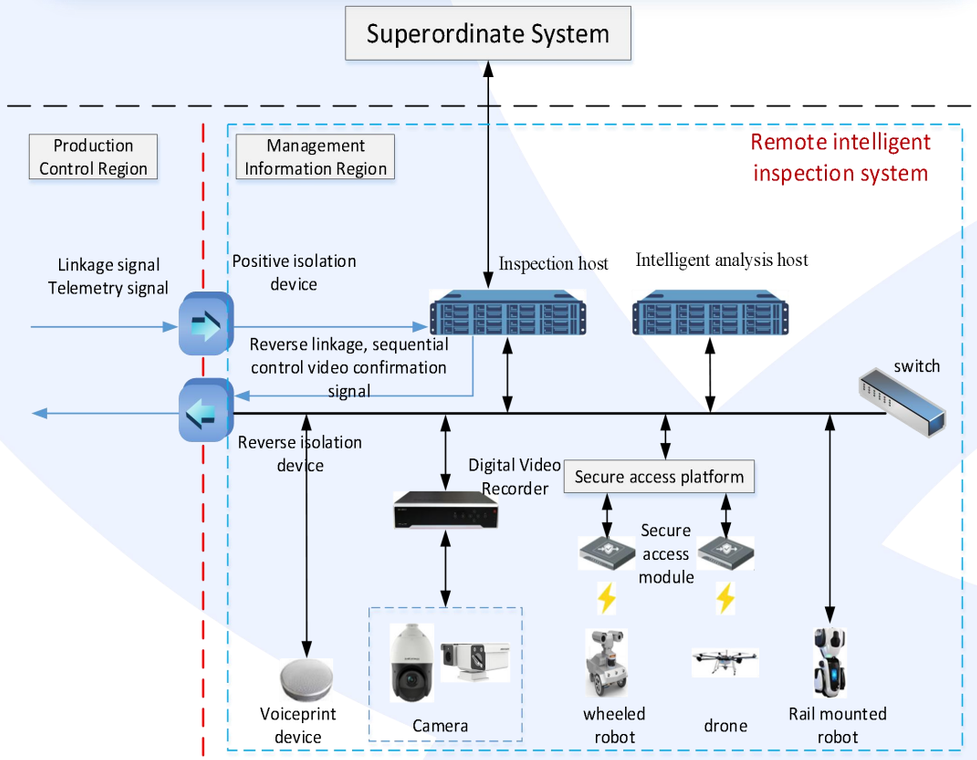
Architecture

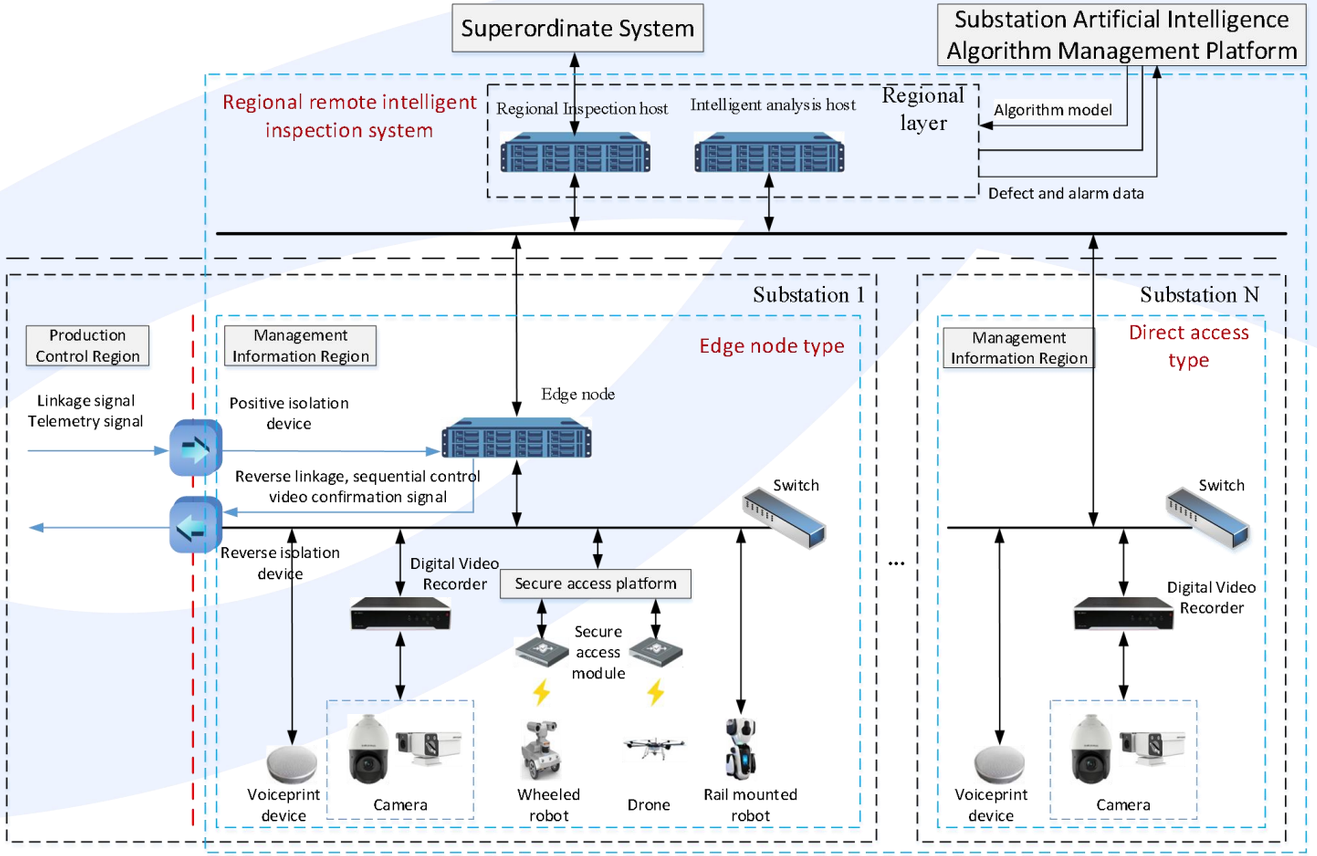


Auxiliary Equipment Control System

Single station remote intelligent inspection system



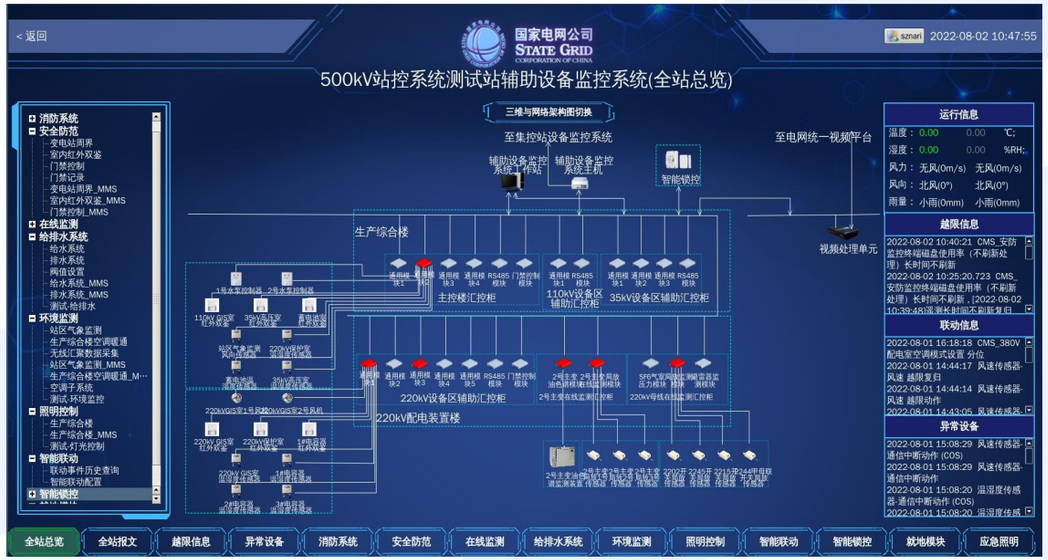
Regional remote intelligent inspection system



Remote Intelligent Inspection System

①PRS-7030 Auxiliary Equipment Control Host

- Support the collection, storage, processing, main auxiliary linkage, software version control, and equipment management of substation auxiliary equipment
- Implement communication between the substation auxiliary equipment monitoring system and the centralized control station equipment monitoring system
- Provide protocol conversion and data, model, and file transmission services for the monitoring and control of centralized control station equipment monitoring systems, information queries, etc



Technical Specifications	Technical Indicators
Processor	Dual processor, 64 bit word length, clock speed ≥ 1.8GHz, ≥ 4 cores
Memory	≥16GB
Hard disk	≥1TB
Ethernet Port	4个100M/1000M
Power	Dual hot swappable redundant power supply
Screen switching response time	Real time screen ≤ 1s, other screens ≤ 2s
Signal delay	Alarm signal delay ≤ 1s, control response time ≤ 1s
Response time for switching between primary and backup machines	≤30s
CPU load	Under normal circumstances (within any 30 minutes) ≤ 30%, during emergencies (within 10 seconds) ≤ 50%
Historical storage	Historical storage time ≥ 3 years

②PRS-7950-IPS Inspection Host

- Realize unified access of monitoring devices, issuance of control and processing of inspection results
- Control the inspection terminal to conduct joint inspections and receive inspection data/files
- Analyze and collect data, generate inspection results/reports, and promptly send alerts
- Real time monitoring and intelligent linkage
- Interact with the remote intelligent inspection centralized monitoring system to support the joint inspection business of the main station

Technical Specifications	Technical Indicators
Processor	Dual processor, 64 bit word length, clock speed ≥ 2.0GHz, ≥ 8 cores
Memory	≥32GB
Hard disk	≥5TB
Ethernet Port	4个100M/1000M
Minimum number of access inspection points	≥20000
Response time for video control switching	＜2s
Monitoring screen display time difference	＜2s
Image recognition algorithm model	Accuracy ≥ 80%, false positive rate<30%, algorithm running time<500ms
Image Discrimination Algorithm Model	Under normal circumstances (within any 30 minutes) ≤ 30%, during emergencies (within 10 seconds) ≤ 50%
One click sequential control video confirmation	Position discrimination accuracy>99%, fault omission rate<0.1%

③PRS-7950-IAS Intelligent analysis host

- Deploy intelligent analysis algorithms such as device status detection, device defect recognition, personnel behavior detection, and environmental status monitoring
- Receive video image data collected by the inspection host, perform image recognition and discrimination of specified analysis types based on video streams and images, and output analysis results to the inspection host

Technical Specifications	Technical Indicators
Chassis	Rack mounted installation, height ≤ 2U, depth ≤ 480mm
Processor	Processor word length 64 bits, clock frequency ≥ 2.0GHz, ≥ 16 cores
Memory	≥ 64GB , ≥ 128GB
Hard disk	≥2TB
Ethernet Port	2个100M/1000M
Intelligent analysis of AI computing power	≥ 64TOPS INT8 , ≥ 128TOPS INT8 , ≥ 256TOPS INT8
Image recognition algorithm model	Accuracy ≥ 80%, false positive rate ≤ 30%, average running time < 500ms
Image Discrimination Algorithm Model	Accuracy ≥ 80%, false positive rate ≤ 30%, average running time < 500ms
One click sequential control video confirmation	Position discrimination accuracy>99%, fault omission rate<0.1%
Data Storage	System data and operation log data storage time ≥ 1 year

③PRS-7950-IPS Regional inspection host

- Access capability of surveillance devices such as cameras and voiceprint monitoring devices, as well as edge node devices, for all substations within the region
- Inspection task issuance, task management, inspection data collection and reception, inspection monitoring, calling intelligent analysis host for intelligent analysis, report generation, and basic configuration management
- Support the joint inspection business of higher-level systems

Technical parameter	Technical indicators
Chassis	Rack mounted installation, height ≤ 2U, depth ≤ 480mm
Processor	Word length of 64 bits, main frequency ≥ 2.0GHz, core count not less than 16 cores
Memory	≥ 64GB (standard), ≥ 128GB (high-end)
Hard Disk	≥ 10TB (standard), ≥ 20TB (high-end)
Ethernet Port	4 100M/1000M adaptive network ports
Number of access inspection points	≥40000
Response time for video control switching	<2s
Monitoring screen display time difference	<2s
High definition video concurrency and redistribution count	≥10

③PRS-7950-EN Edge Node

- Unified access and interaction with regional inspection hosts and on-site main and auxiliary monitoring systems
- When there is a need for intelligent linkage or one click sequential control video double confirmation, configuration is required
- When there are inspection devices such as robots and drones, they need to be configured
- Support autonomous execution of inspection tasks, ensuring uninterrupted inspection tasks when the substation and regional inspection host network

Technical parameter	Technical indicators
Chassis	Rack mounted installation, height ⩽ 2U, depth ⩽ 480mm
Processor	Word length of 64 bits, main frequency ⩾ 1.8GHz, core count not less than 8 cores
Memory	⩾16GB
Hard Disk	⩾2TB
Ethernet Port	2 100M/1000M adaptive network ports
Number of access inspection points	⩾6000
Response time for video control switching	＜2s
Monitoring screen display time difference	＜2s
Data Storage	1) The storage time of images, audio, defect videos and other files is ⩾ 1 year 2) Structured data storage time for inspection results, alarm data, etc. ⩾ 3 years

④PRS-7954-FI-TCU-ZK Fire information transmission control unit

- Using RS485/RJ45/CAN communication to connect to the automatic fire alarm system
- Using hard contacts to connect controlled fire-fighting equipment
- Using analog signals to connect to transmitters for fire water tank level, pipeline pressure, power supply voltage, etc
- Upload information to auxiliary equipment monitoring system via IEC 61850
- Control fire protection facilities through hard contact or RS485/RJ45/CAN operation

Technical Specifications	Technical Indicators
Communication Port	4 RJ45 Ethernet interfaces, 2 pairs of LC fiber optic interfaces, 1 CAN interface, 6 RS485 interfaces, and 1 RS232 interface
4~20mA analog quantity	6
Hard contact input	72 channels of conventional 24V input , 35 sets of input feedback, input SOE resolution ≤ 1ms
Hard contact output	35 output
Abnormal empty contact point	1 pair of abnormal normally open contacts of the device, triggered when the device software module alarms
Fault empty contact point	1 pair of normally closed contacts due to device malfunction, triggered when the device fails to operate due to power failure or hardware malfunction
Operating Voltage	DC/AC 220V
Operating Temperature	-25℃～55℃
Historical event records	2048 records, able to maintain information for 14 days after power failure
Action Time	Received control command until contact closure ≤ 1s

⑤PRS-7956-SD-SD-ZK Security monitoring terminal

- Connect security terminal equipment using hard contacts, RJ45 or RS485 communication methods
- Upload information to auxiliary equipment monitoring system via IEC 61850
- Control operations are performed through hard contacts or RJ45/RS485 communication according to system instructions

Technical Specifications	Technical Indicators
Ethernet Port	4 RJ45 Ethernet interfaces, 2 pairs of LC fiber optic interfaces
Hard contact input	54 channel DC 24V input access, input value SOE resolution ≤ 1ms
Hard contact output	14 relay contacts output, long-term allowable closing current ≥ 5A, short-term allowable closing current ≥ 30A, 200ms
Serial	6 RS485 interfaces，1 RS232 interface
Abnormal empty contact point	1 pair of abnormal normally open contacts of the device, triggered when the device software module alarms
Fault empty contact point	1 pair of normally closed contacts due to device malfunction, triggered when the device fails to operate due to power failure or hardware malfunction
Screen refresh time	≤1s
Control response time	≤5s
Operating Voltage	DC/AC 220V，DC 24V
Operating Temperature	-25℃～55℃

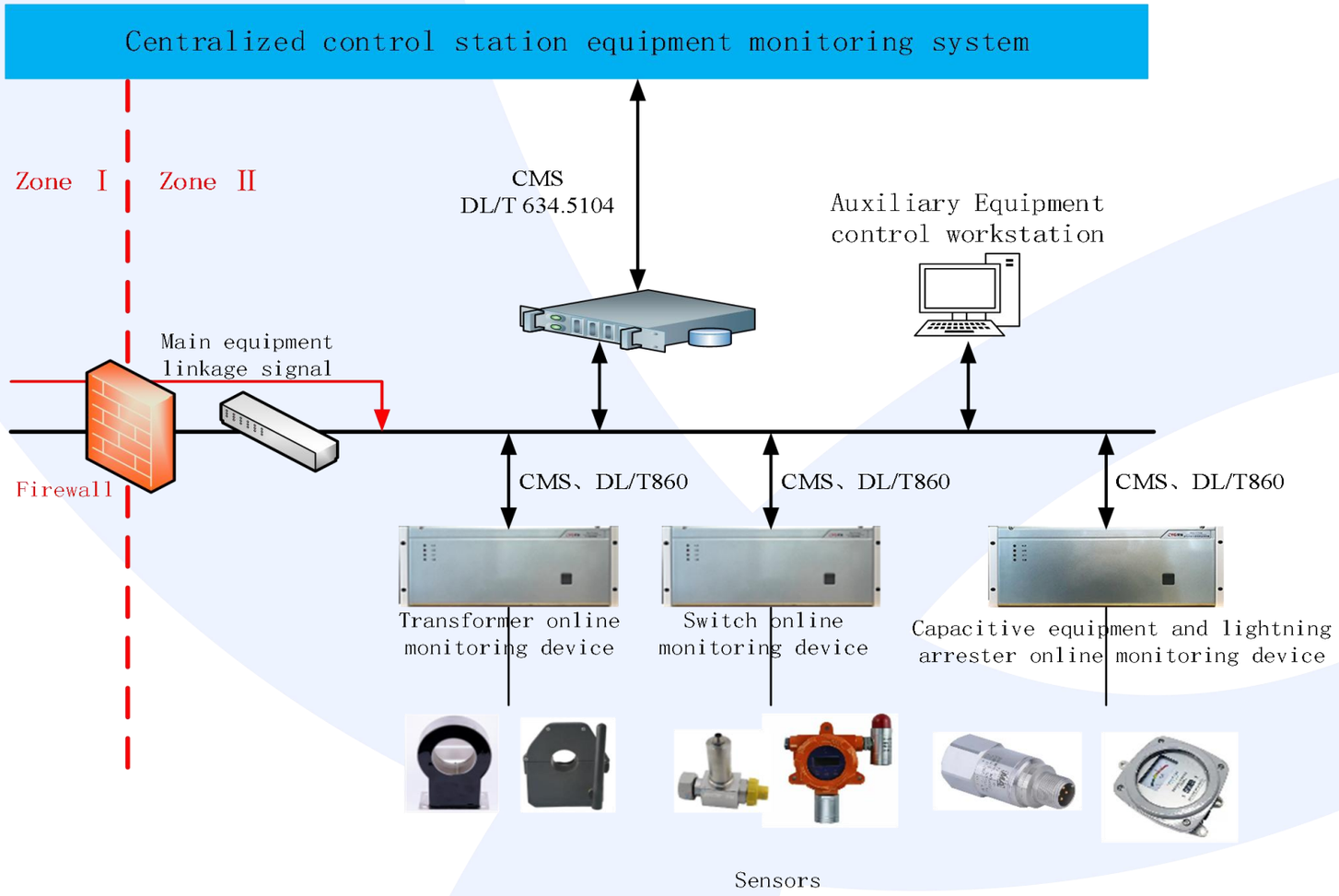
⑥PRS-7955-PE-PED-ZK Dynamic environmental monitoring terminal

- Connect the dynamic environmental monitoring terminal equipment using hard contacts or RS485 communication methods
- Upload information to auxiliary equipment monitoring system via IEC 61850
- Control operations through hard contacts or RS485 communication according to system instructions

Technical Specifications	Technical Indicators
Ethernet Port	4 RJ45 Ethernet interfaces, 2 pairs of LC fiber optic interfaces
Hard contact input	54 channel DC 24V input access, input value SOE resolution ≤ 1ms
Hard contact output	14 relay contacts output, long-term allowable closing current ≥ 5A, short-term allowable closing current ≥ 30A, 200ms
Serial	6 RS485 interfaces，1 RS232 interface
Abnormal empty contact point	1 pair of abnormal normally open contacts of the device, triggered when the device software module alarms
Fault empty contact point	1 pair of normally closed contacts due to device malfunction, triggered when the device fails to operate due to power failure or hardware malfunction
Screen refresh time	≤1s
Control response time	≤5s
Operating Voltage	DC/AC 220V，DC 24V
Operating Temperature	-40℃～70℃

PART 03

Function

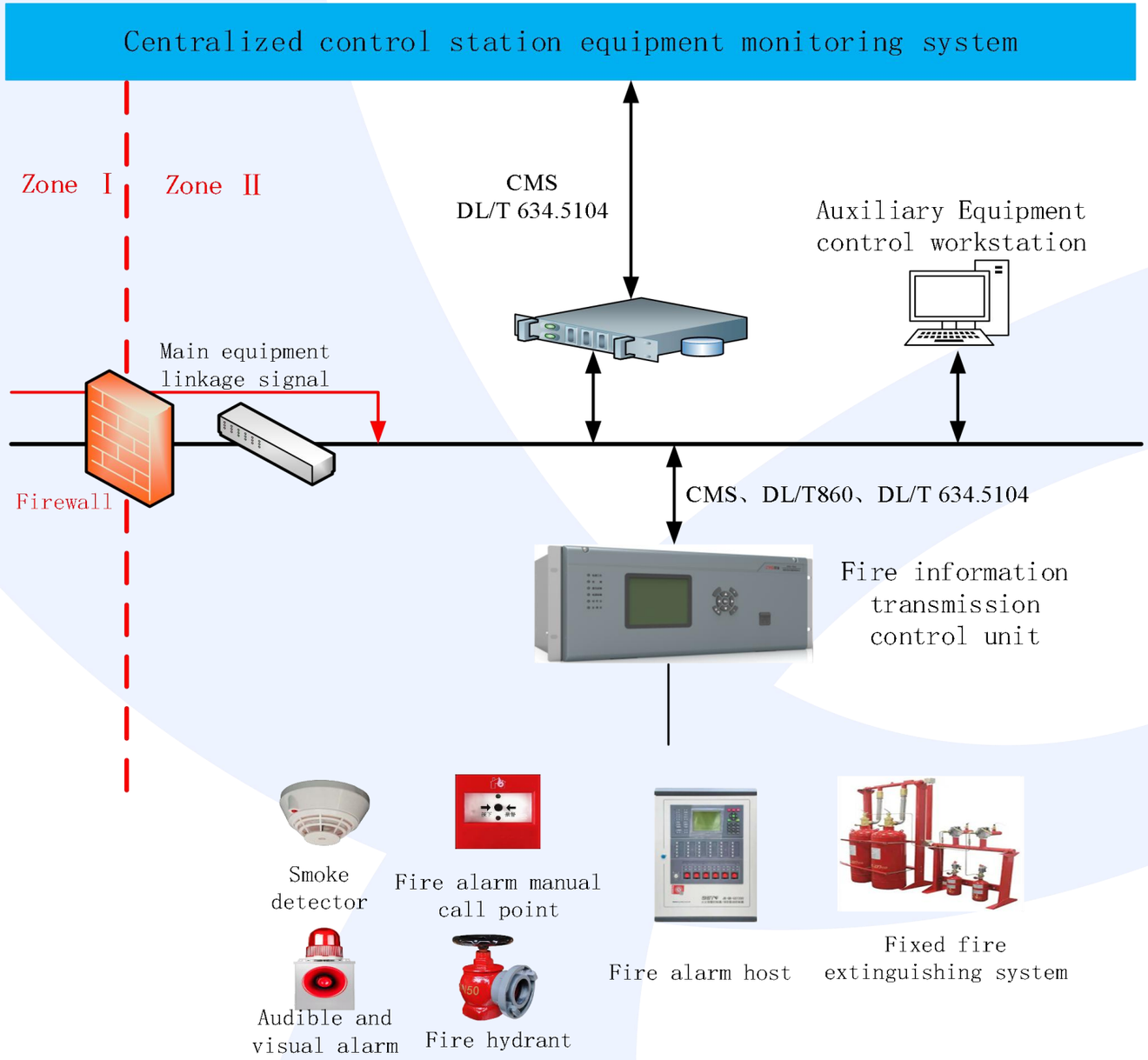


Monitoring

- Information monitoring and analysis of transformer online monitoring data
- Information monitoring and analysis of switch online monitoring data
- Information monitoring and analysis of online monitoring data for capacitive devices
- Information monitoring and analysis of lightning arrester online monitoring data

Control

- Remote control and active operation of real-time monitoring and sampling data
- Switching of monitoring data display mode, threshold/status alarm configuration, sampling frequency configuration
- Equipment alarm confirmation

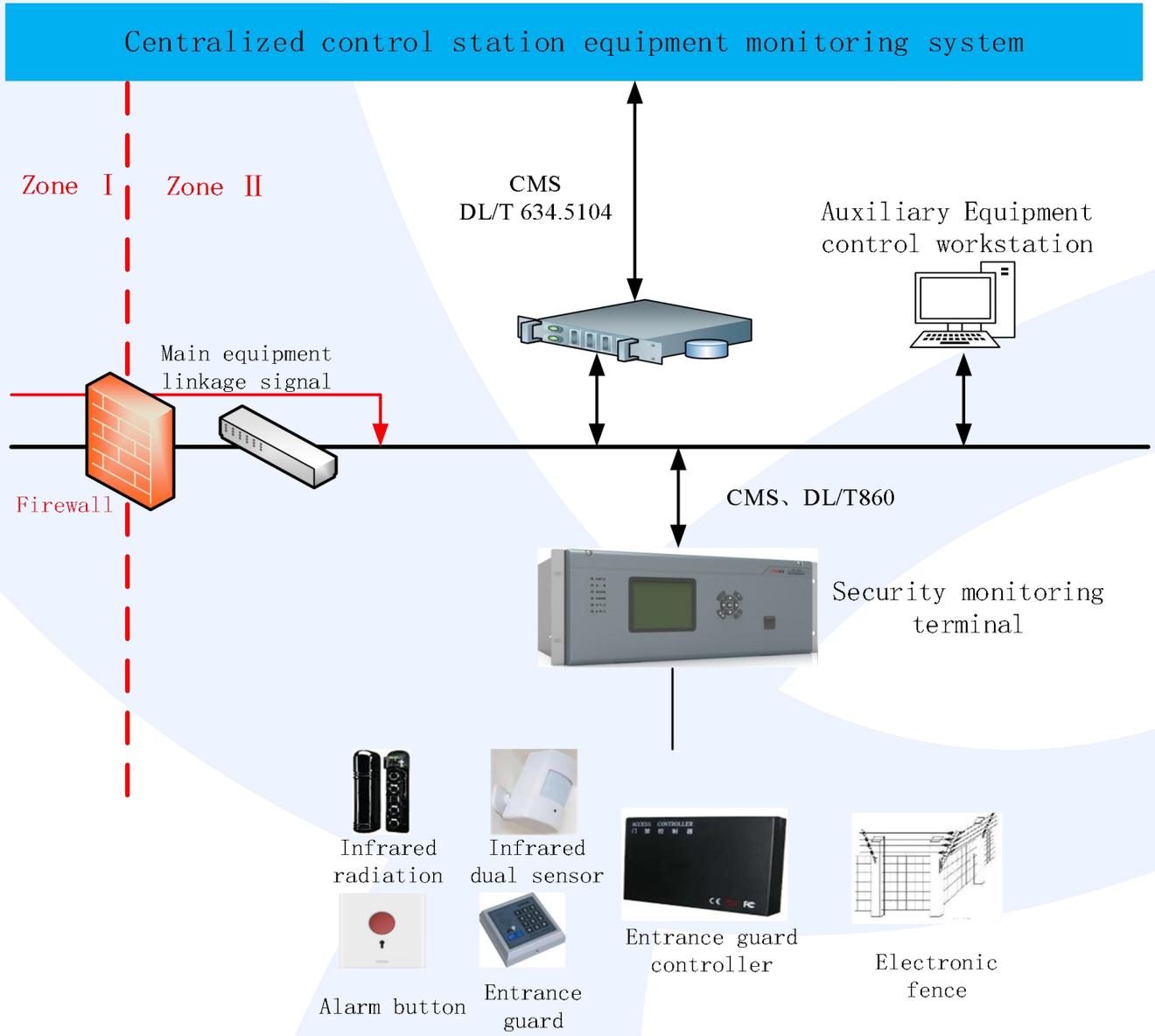


Monitoring

- Regional fire alarm controller monitoring
- Fire alarm points, start stop status, action feedback, supervision, shielding, and fault information monitoring of fire-fighting equipment
- Monitoring of information collected by other fire sensors

Control

- Fire alarm system alarm confirmation
- Remote verification, reset, and isolation of faulty equipment for alarm signals of regional fire alarm controllers
- Local and remote start and stop of fixed fire extinguishing system, supporting manual and automatic mode local switching

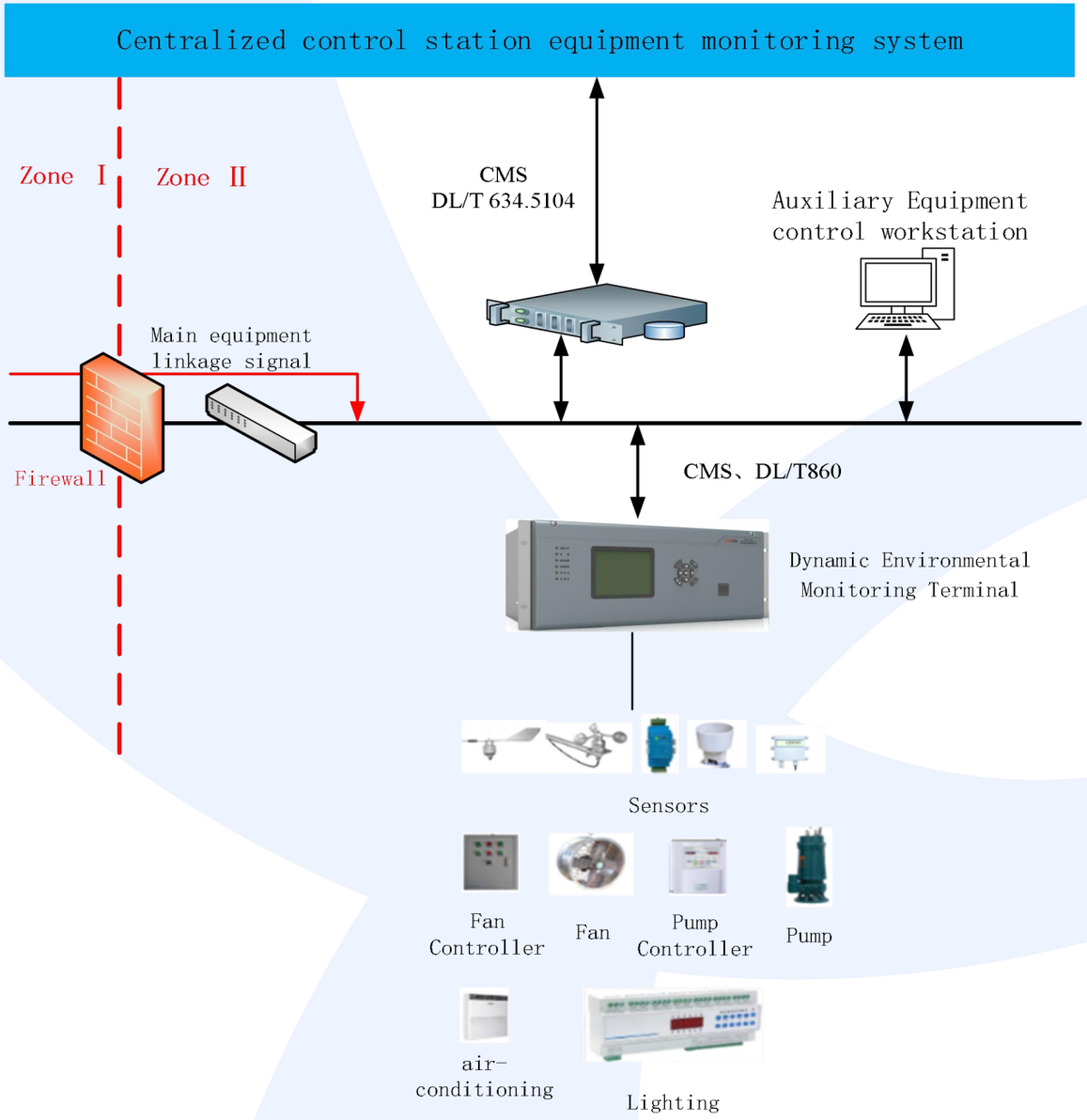


Monitoring

- electronic fence
- Infrared radiation
- Infrared dual sensor
- access control panel

Control

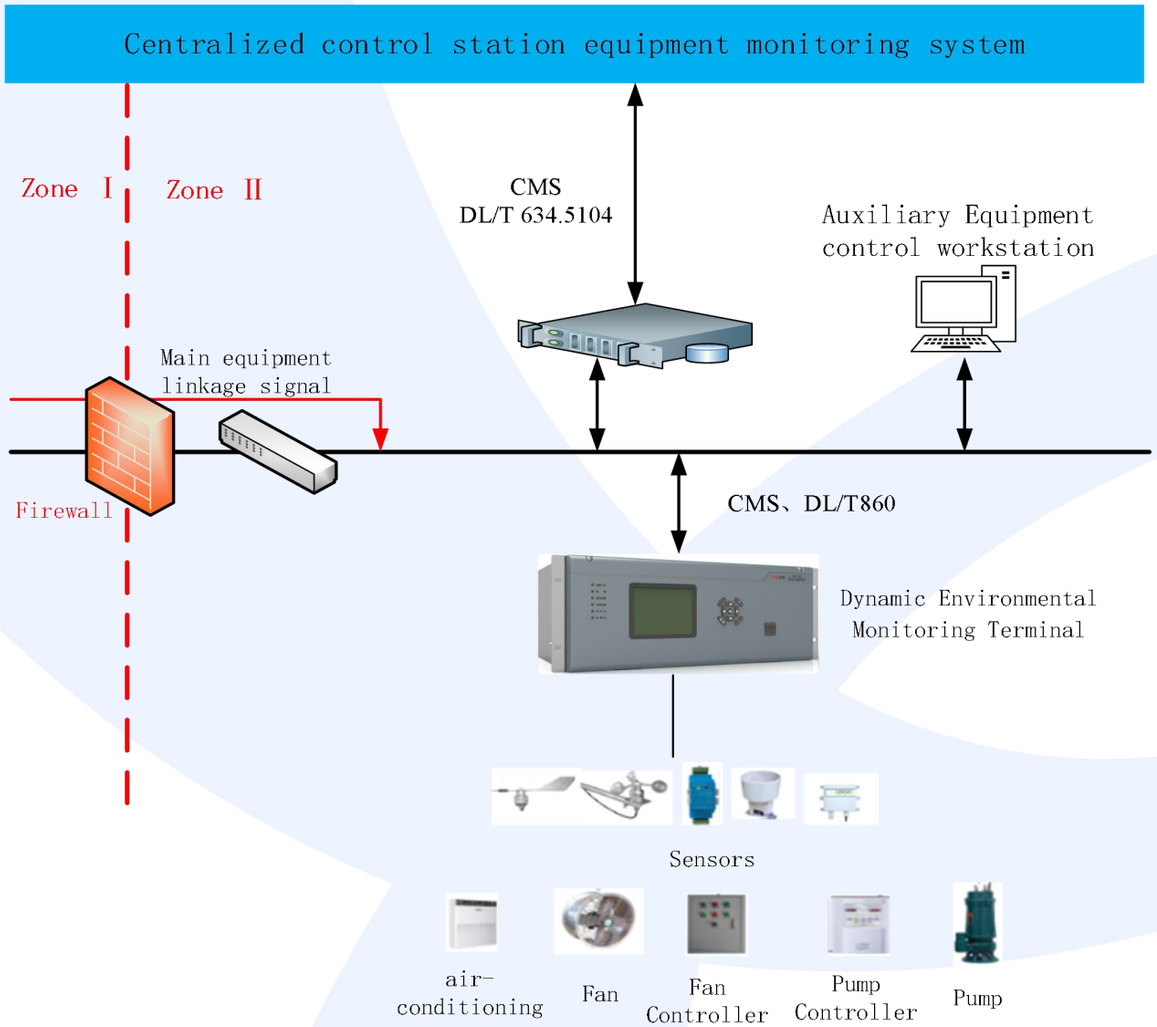
- Information modification and alarm confirmation of intrusion prevention devices
- System remote deployment, disarming, and equipment remote reset
- Anti intrusion alarm sound and light alarm control, trigger time and alarm delay settings
- Electronic fence maintenance and tagging
- Remote access control configuration, authorization, and door opening



Monitoring

- Sensor measurement values: including temperature, humidity, etc
- Equipment operating status: including the start/stop operation status of fans, water pumps, dehumidifiers, etc
- Air conditioning operating parameters: including wind direction, wind speed, etc
- Operation status of various sensors: including temperature and humidity sensors, water level sensors, water immersion sensors, wind speed sensors, etc
- Sensor alarm information: including water immersion alarm, motor circuit power failure alarm, etc

Monitoring of dynamic environmental system



Control

- Remote adjustment of air conditioning
- Remote start/stop control and maintenance tagging of wind turbines
- Remote start/stop control and maintenance tagging for water pumps
- Remote start/stop control and maintenance tagging for dehumidifiers
- Temperature, humidity, wind speed, rainfall, water level and other threshold alarm configurations, al arm mode settings
- Indoor temperature and humidity limit alarm settin g, automatic control of air conditioning (fan) sta rt/stop, operation mode adjustment, etc
- Water immersion alarm in the collection well, auto matic control of water pump start, delayed stop

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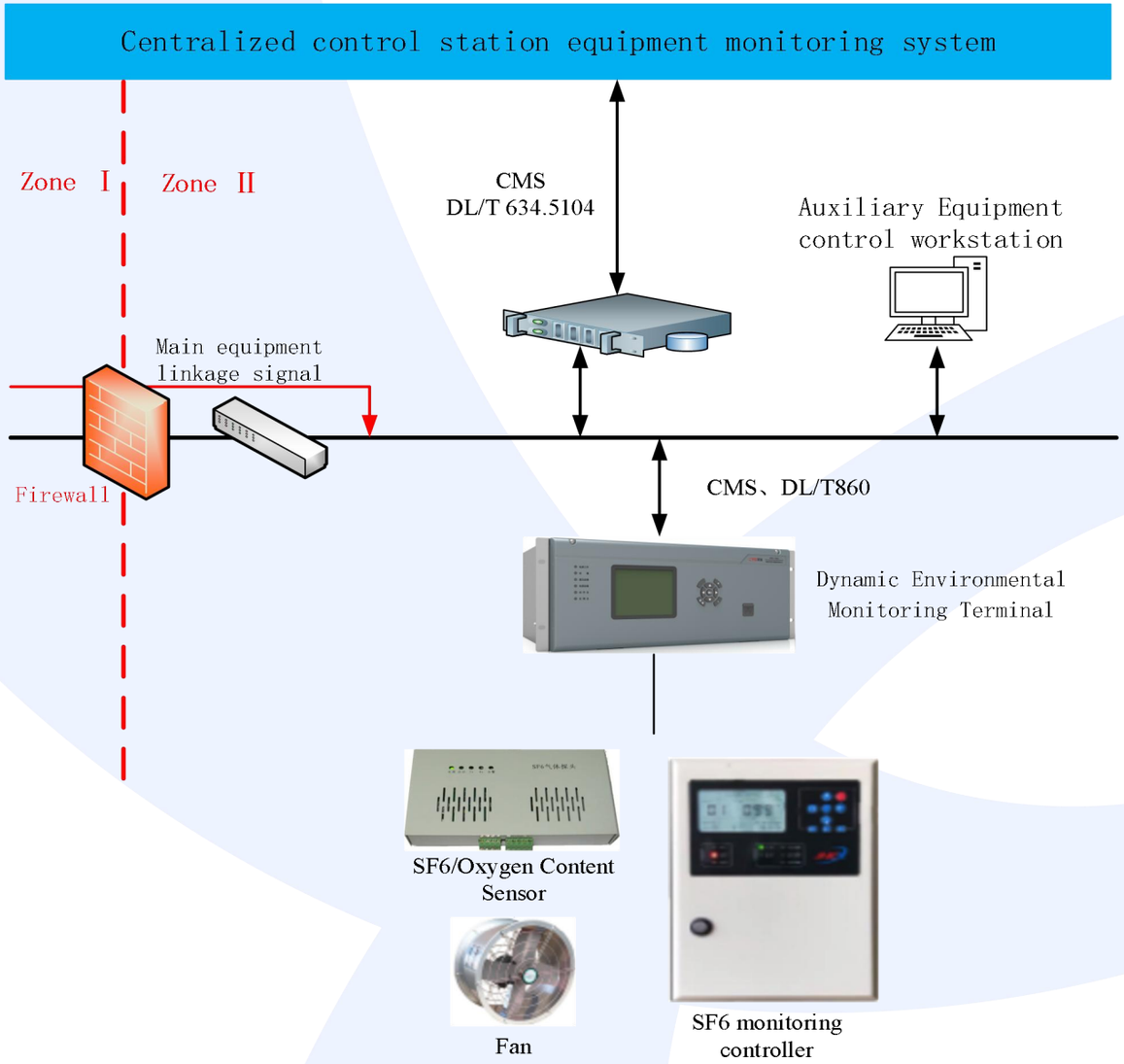
SF6 monitoring of dynamic environmental system



Monitoring

- ◆SF6、 Oxygen gas concentration
- ◆Alarm for low oxygen concentration and alarm for excessive SF6 concentration
- ◆SF6 sensor operating status
- ◆Operation status of SF6 monitoring controller

Control

- ◆Remote start/stop control, timed control, and maintenance tagging of exhaust fans
- ◆SF6、 Oxygen concentration threshold alarm configuration, supporting alarm mode settings
- ◆SF6 alarm automatically starts exhaust fan
- ◆SF6 alarm automatically starts on-site sound and light alarm

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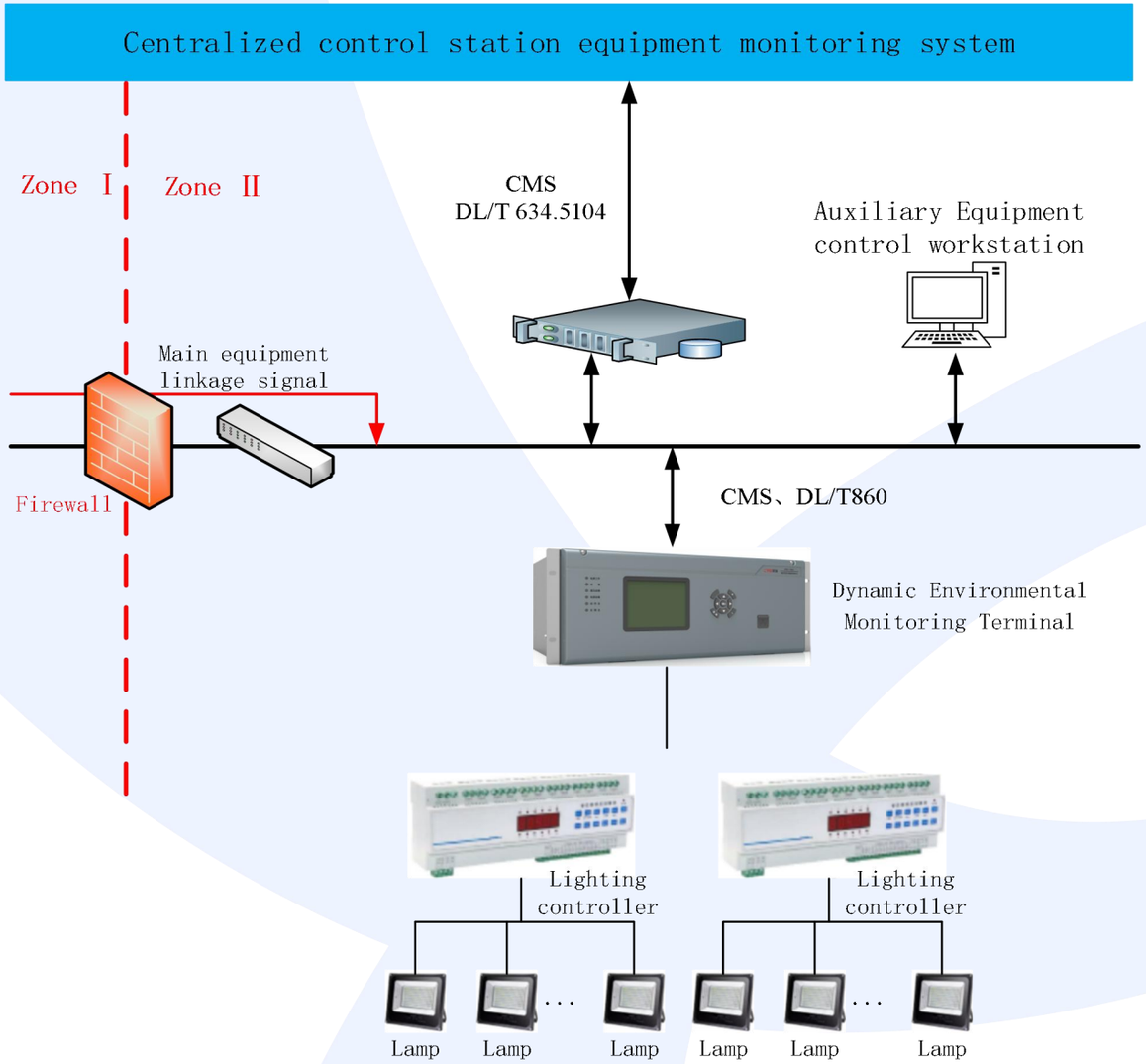
Lighting control of dynamic environmental system



Monitoring

- On/off status of lighting fixtures
- Operation status of lighting controller
- Working status of lighting control circuit

Control

- Local control of lighting on/off
- Remote control of lighting on/off
- Area control lighting on/off
- Timed control of lighting fixtures on/off
- Strategic control of lighting on/off
- Hanging maintenance of lighting fixtures

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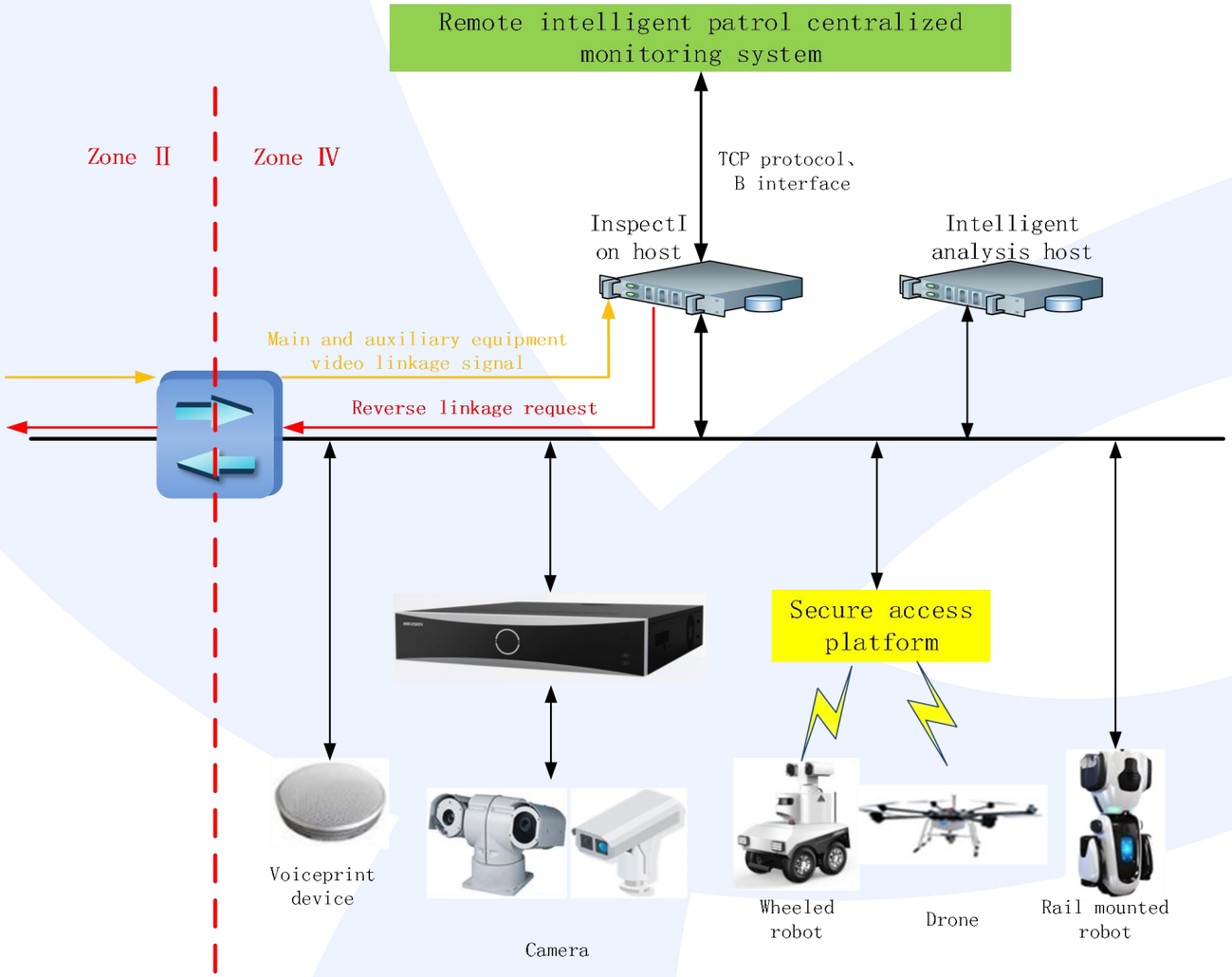
Remote intelligent inspection



- High definition video, robot, drone, voiceprint device data collection
- Real time monitoring
- Operation control
- video replay
- Monitoring point screen polling
- Intelligent Analysis
- Task Management
- Real time monitoring of patrol tasks
- Confirmation of Inspection Results
- Analysis of Inspection Results
- Smart Linkage
- One click sequential control video confirmation
- Inspection equipment ledger management
- 3D browsing, 3D interaction, 3D inspection
- Reliability index statistics
- System self-check

PART 04

Key Technology

Equipment status monitoring

- Real time monitoring based on streaming media
- Voiceprint analysis based on audio data

Intelligent Image Analysis

- Equipment status detection
- Equipment defect detection
- Personnel behavior detection
- Environmental status detection

Fault linkage handling

- Visual monitoring based on intelligent linkage
- Emergency response based on intelligent linkage

Remote intelligent inspection

- Parallel inspection based on multi task scheduling
- Intelligent inspection based on multidimensional data fusion

Temperature measurement inspection of power equipment

- Online temperature measurement of power equipment
- Thermal imaging intelligent diagnosis

Sequential control video double confirmation

- Visualization of the process of one click sequential control operation
- Device state detection based on video frame extraction

(1) Real time monitoring based on streaming media

Complete system functions

- Real time video surveillance
- PTZ/preset position control
- Historical video playback
- Visible light video control
- Infrared video control
- video patrol
- ...

Diverse access objects

- HD camera
- Rail robots
- wheeled robot
- quadruped robot
- drone
- Voiceprint monitoring
- ...

Rich video protocols

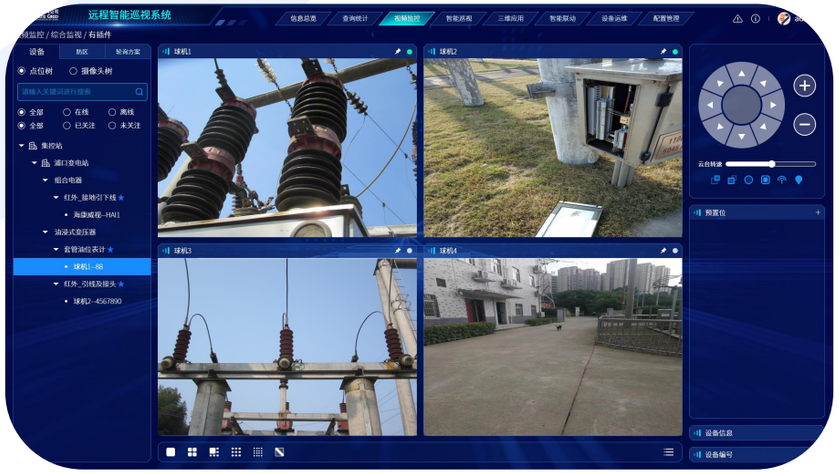
- Milestone Video Protocol
- ONVIF Standard Protocol
- SIP Standard Protocol
- ...

Powerful transcoding capability

- Arbitrary transcoding between audio and video
- Software and hardware adaptive transcoding
- Dynamically increase or decrease transcoding
- On demand transcoding
- ...

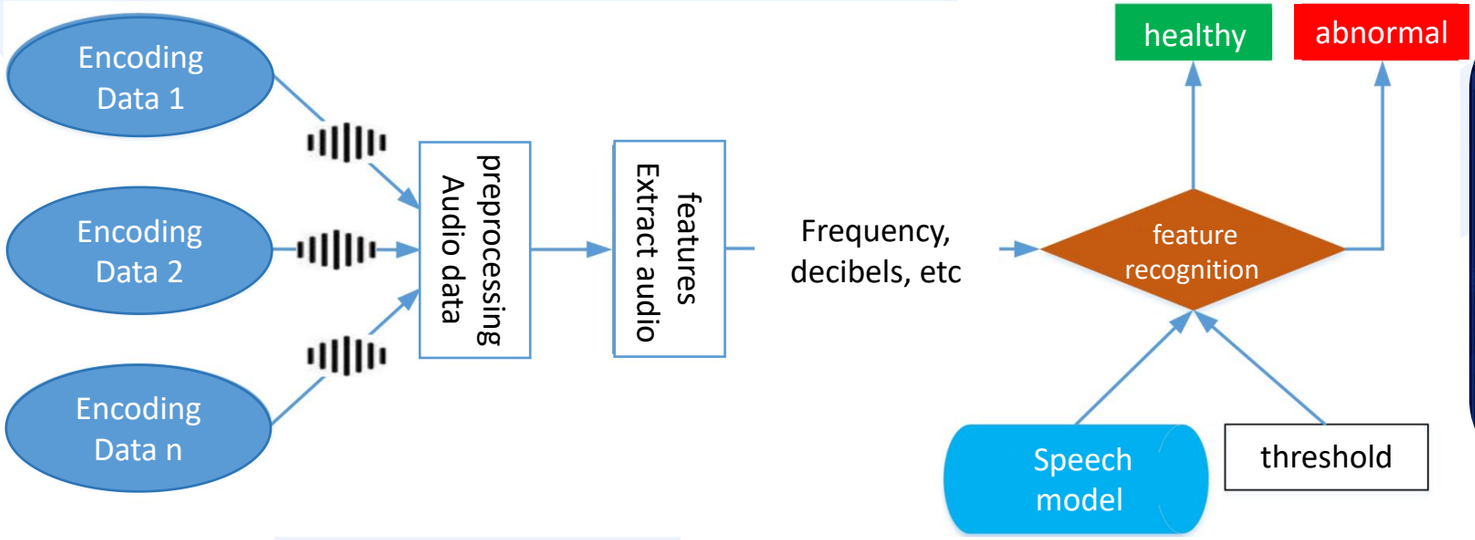
Flexible deployment methods

- Virtualization deployment
- Containerized deployment
- Microservices
- componentization
- ...



(2) Voiceprint analysis technology based on audio data

- Equipped with a voiceprint diagnostic model for power equipment, the voiceprint monitoring system enables 24-hour online monitoring of important equipment such as transformers and high impedance devices. The collected device voiceprint data is subjected to special diagnosis extraction and feature analysis, enabling timely warning and display of various equipment faults.
- Provide the change curve of device voiceprint information for operation and maintenance personnel to assist them in assessing the operating status of the equipment.



(1) Parallel inspection based on multi task scheduling

Using multi task scheduling technology, a parallel inspection mode with multiple inspection devices is adopted during the execution of inspection tasks, which changes the disadvantage of long inspection task time caused by single device serial inspection in the past and improves the efficiency of on-site inspection task execution.

- **Parallel inspection:** The system defaults to selecting 4/8/16/32/64 patrol devices for parallel inspection, and supports customizing the number of parallel inspection routes based on the number of on-site access device points;
- **Inspection efficiency:** With approximately 5000 inspection points throughout the station, the inspection time is controlled at around **30 minutes**.

(2) Intelligent inspection based on multidimensional data fusion

Integrating and analyzing monitoring data from different sources to achieve multi-dimensional perception of equipment status, truly achieving internal measurability and external observability of the equipment.

- **Equipment inspection data:** collected jointly by cameras, robots, drones, voiceprint monitoring and other inspection equipment, including visible light video and image, infrared spectrum, audio and other inspection data;
- **Online monitoring data:** obtained through the main and auxiliary equipment monitoring system, including online monitoring data of primary equipment and secondary equipment.

巡检报告

变电站	500kV站控系统测试站	电压等级	500kV
巡视日期	2023-07-27	变电站类别	GIS站
巡视任务	摄像机全点位巡视任务	环境信息	
审核人	caozuo	审核时间	2023-07-27 15:21:34
巡视开始时间	2023-07-27 14:41:44	巡视结束时间	
巡视统计	总点位32个，已检点位32个，未检点位0个，正常点位25个，异常点位7个		
巡视结论	a		

异常点位汇总

编号	区域	间隔	设备	部件	点位	数据来源	采集时间	巡视结果	点位状态	巡视图像
1	500kV	站控系统测试场站1号支架	1号支架测试场站设备	1号支架测试可见光表记部件	1号支架呼吸器	摄像机	2023-07-27 14:43:32	[呼吸器-硅胶变色],[油位状态-呼吸器油封油位异常]	异常	2023-07-27 14:43:32.jpg
2	500kV	站控系统测试场站2号支架	2号支架测试场站设备	2号支架测试可见光表记部件	2号支架压板	摄像机	2023-07-27 14:42:52	[开关柜-压板分],[开关柜-压板分],[开关柜-压板分],[开关柜-压板分],[开关柜-压板	异常	2023-07-27 14:42:52.jpg
3	500kV	站控系统测试场站2号支架	2号支架测试场站设备	2号支架测试可见光表记部件	2号支架呼吸器	摄像机	2023-07-27 14:43:36	[呼吸器-硅胶变色],[油位状态-呼吸	异常	

(1) Equipment status detection

Application scenarios

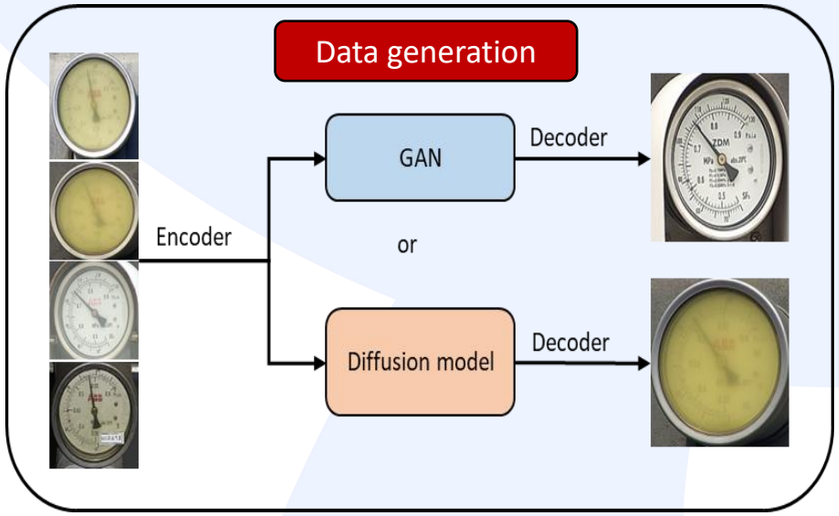
- Identification of opening and closing indication
- Instrument reading recognition
- Oil level gauge identification
- Link Status Recognition
- Cabinet door status recognition
- …

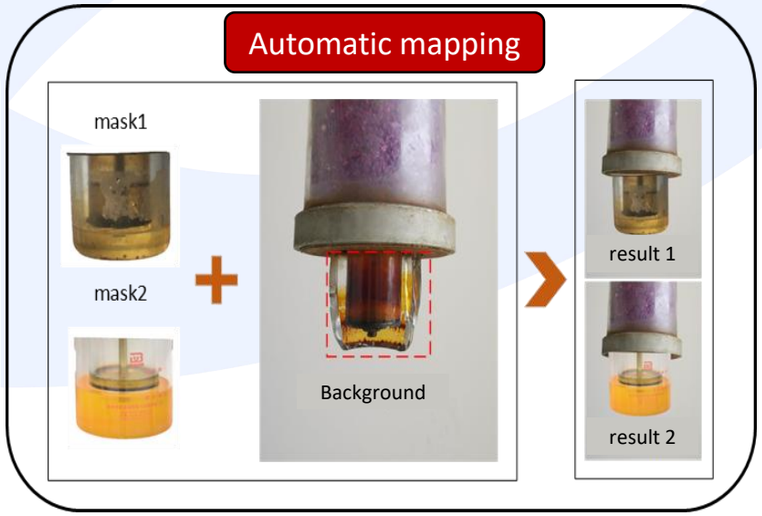
Technical challenges

- Equipment types vary greatly
- Complex device features and unclear differentiation of different device features
- Difficult to extract universal and highly adaptable device features

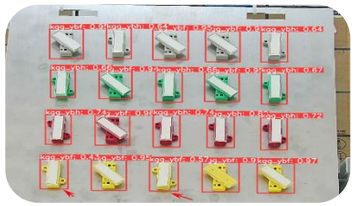
Solution

- **Data augmentation:** data generation (GAN, Stable Diffusion technology), automatic mapping
- **Adding fine-grained classification for post detection processing,** such as PCA Net, can accurately classify images using smaller features throughout the entire image. For example, if the meter reading is abnormal, only the pointer angle can be used to determine whether it is abnormal; Opening and closing indication, determining the opening and closing status through detailed features such as opening, closing, or 0, 1, etc

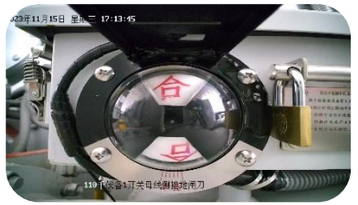




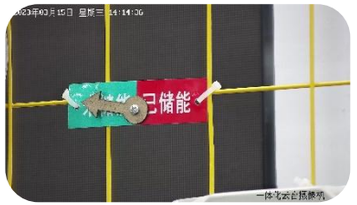
Meter reading



Link status



Open/Close Indicator



Energy storage indication status

(2) Equipment defect detection

Application scenarios

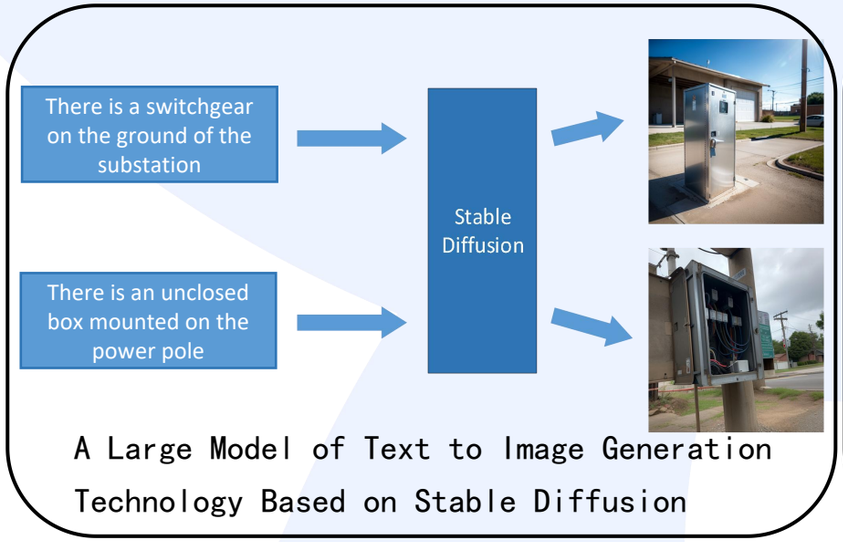
- Ground oil pollution
- Abnormal appearance of equipment
- Damaged insulator
- Silicone cylinder damaged
- Silicone discoloration of respirator
- …

Technical challenges

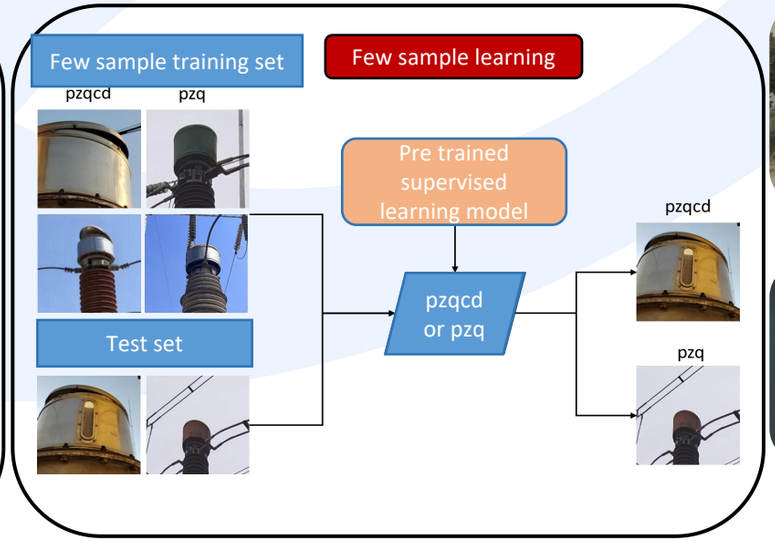
- Unequal distribution of positive and negative samples
- Defect morphology is not fixed
- Detecting susceptibility to environmental factors such as weather and lighting
- Poor generalization ability of the model

Solution

- **Small sample expansion:** text to image
- **Training optimization:** One shot/new shot learning
- **Model fine-tuning:** Freeze the backbone network and then fine tune the unfrozen parts of the model for different substation scenarios to improve the generalization of algorithms between stations

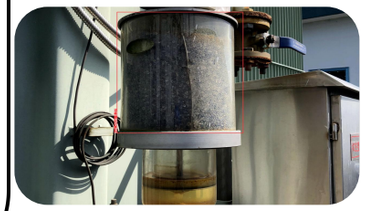


A Large Model of Text to Image Generation Technology Based on Stable Diffusion



Ground oil pollution

Damaged insulator



Silicone cylinder damaged

Silicone discoloration of respirator

(3) Personnel behavior detection

Application scenarios

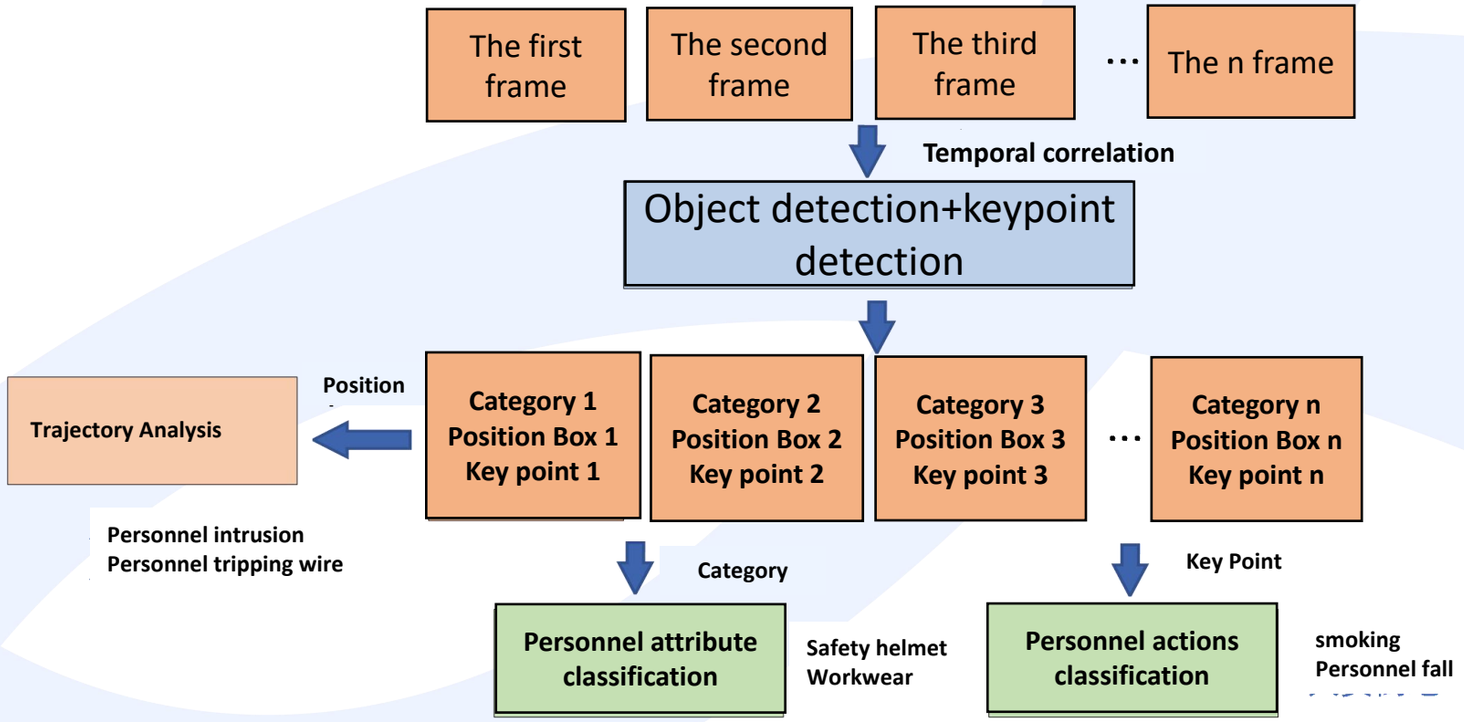
- Personnel invasion, personnel falling to the ground, personnel gathering
- Not wearing work clothes, not wearing a safety helmet
- Smoking and making phone calls
- Other abnormal behaviors

Technical challenges

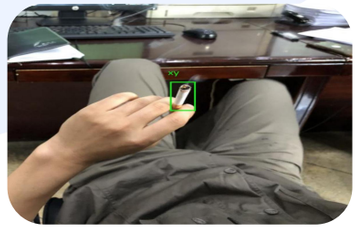
- Personnel behavior is easily obstructed
- The posture of the human body changes significantly during movement, and diagnosis based on a single captured image is prone to false alarms

Solution

- Using human keypoint detection and image segmentation instead of object detection
- Using occlusion adaptive strategy based on dynamic trajectory analysis to enhance robustness



Not wearing work clothes, not wearing a safety helmet



Smoking

Personnel Intrusion

Call

(4) Environmental status detection

Application scenarios

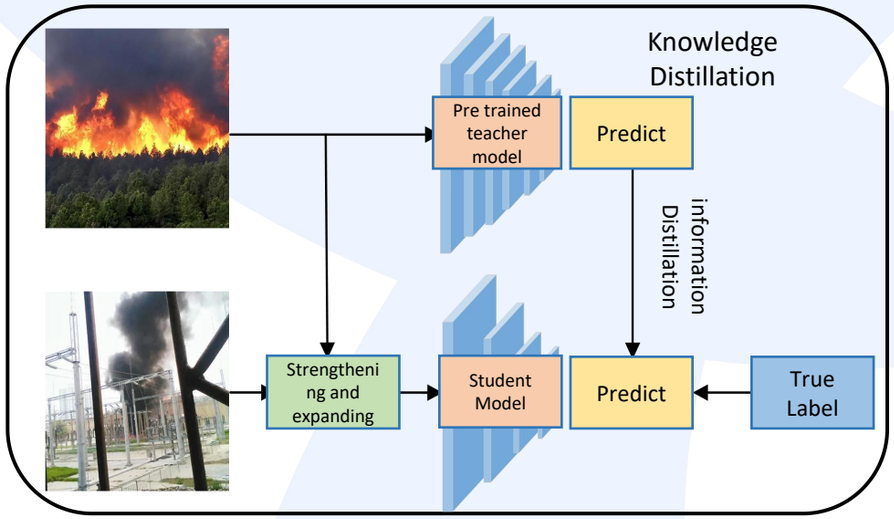
- fire smoke
- Bird's nest, suspended solids hanging in the air
- Small animals intrusion
- Damaged or missing cover plate
- Damage to doors, windows, walls, and floors
- …

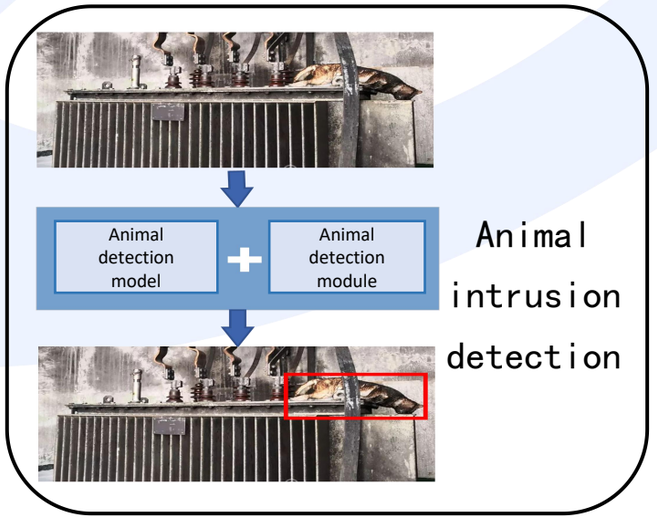
Technical challenges

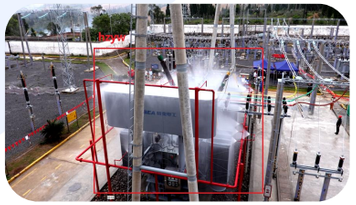
- Foreign objects with diverse forms are prone to missed detection
- It is difficult to collect data on fires and small animals in substation scenarios

Solution

- Transfer learning and knowledge distillation: using large models trained on fire smoke data from other fields to guide substation scene models
- Small animal intrusion detection: using industry standard detection models for transfer learning, combined with animal detection modules, to fuse and determine the presence of live animals entering

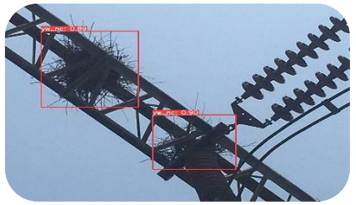






Fire smoke

Hanging suspended solids



Nest

Damaged or missing cover plate

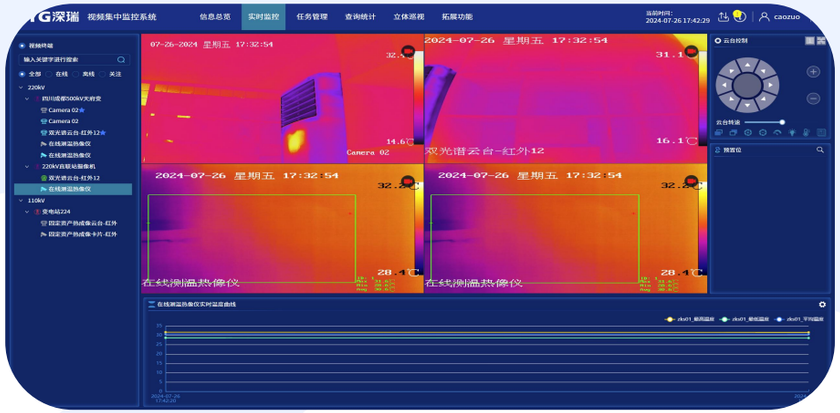
(1) Online temperature measurement of power equipment

Objective

- transformer
- Transformer oil storage tank
- Transformer outgoing bushing
- ...

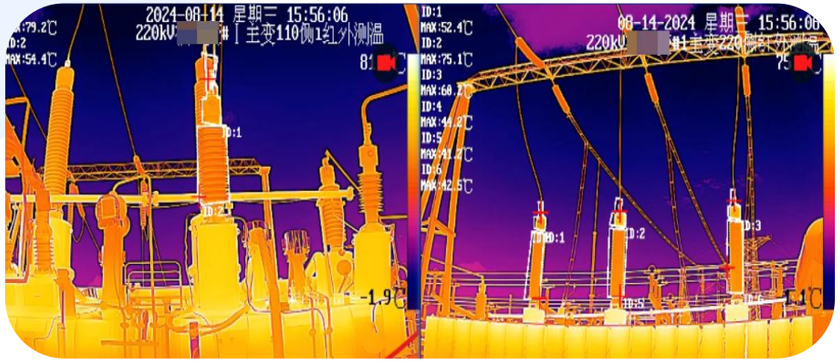
- Switch gate
- Switch blade
- Switch ceramic pillar body
- ...

- Capacitor/Reactor
- Small bushing for capacitors/reactors
- ...



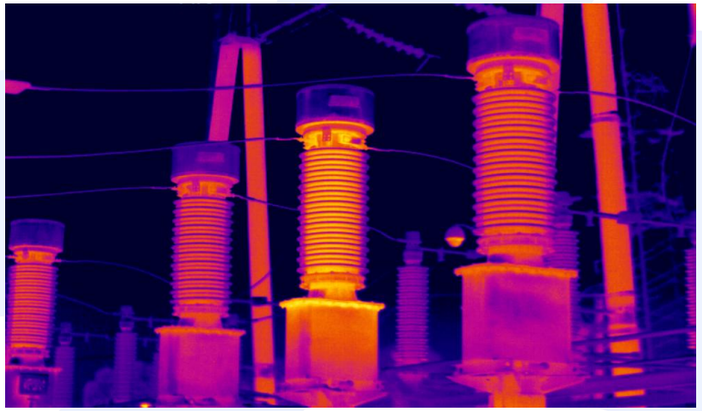
System functional characteristics

- Temperature measurement of components in equipment prone to heat generation
- One click remote temperature measurement (manual/automatic)
- Large measurement range: -20 ℃~550 ℃
- High measurement accuracy: ± 2 ℃, ± 2%
- There are various temperature measurement methods available
- Automatic temperature abnormality alarm and manual review
- One click control of temperature history curve and changes
- Temperature measurement report export and post tracking

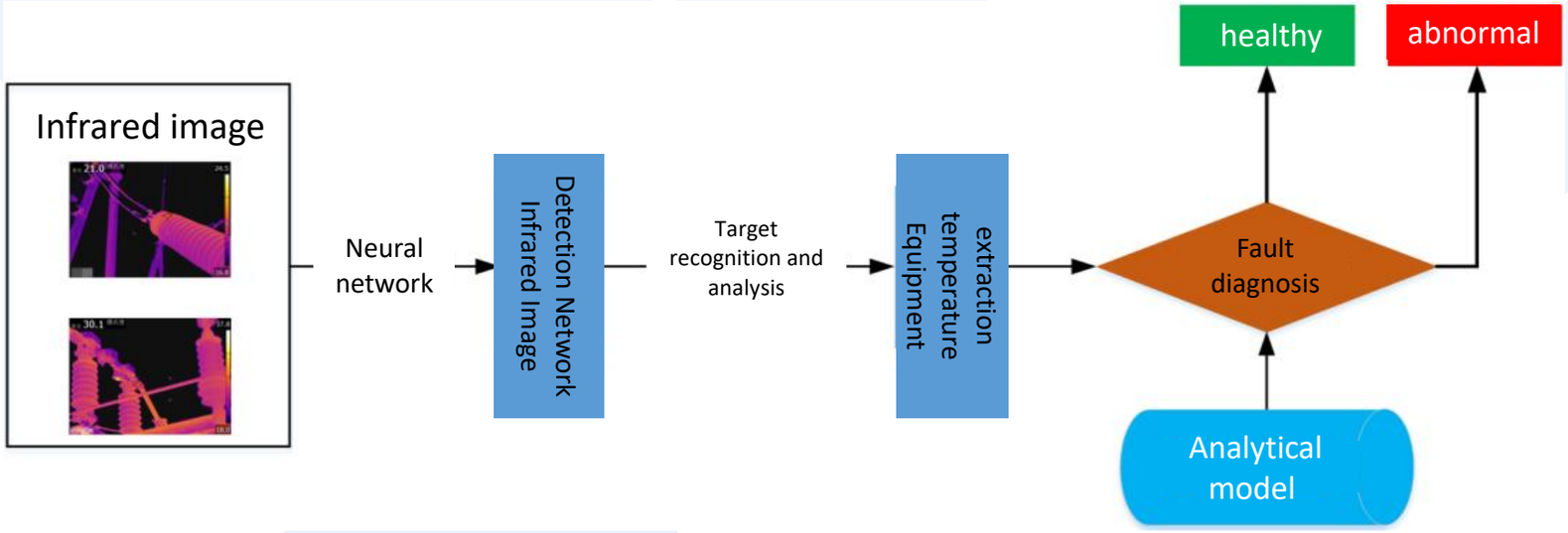


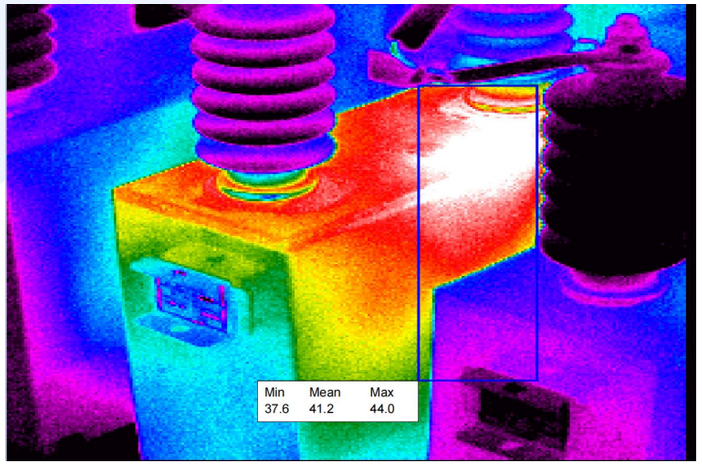
(2) Thermal imaging intelligent diagnosis

- Equipped with an infrared diagnostic fault analysis model for power equipment, combined with environmental temperature and wind speed conversion, it achieves precise thermal imaging temperature measurement and automatic/manual inspection of power equipment
- Utilizing the collected thermal imaging information for real-time analysis and temperature difference analysis, combined with fault analysis models to provide diagnostic results and proactive warning.
- Provide real-time/historical analysis of power equipment temperature, support obtaining thermal imaging real-time/historical video thermal maps and conducting temperature analysis, and achieve real-time full monitoring and analysis of equipment problems.



High dielectric loss in phase B leads to heating





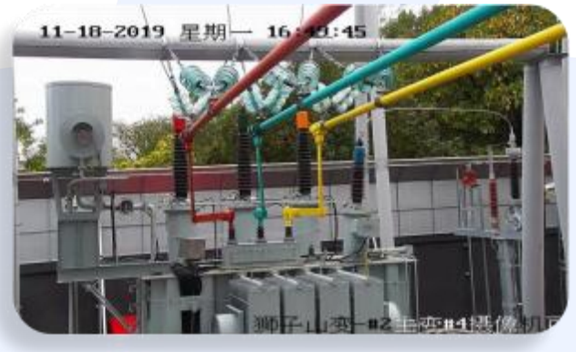
Local heating of capacitors

(1) Visual monitoring based on intelligent linkage

Driven by data sharing and fusion, applying visual monitoring technology of "signal+video" to achieve integrated panoramic monitoring of substations

Integrated visual monitoring of main equipment

- Primary equipment alarm
- Secondary equipment alarm
- Accident tripping



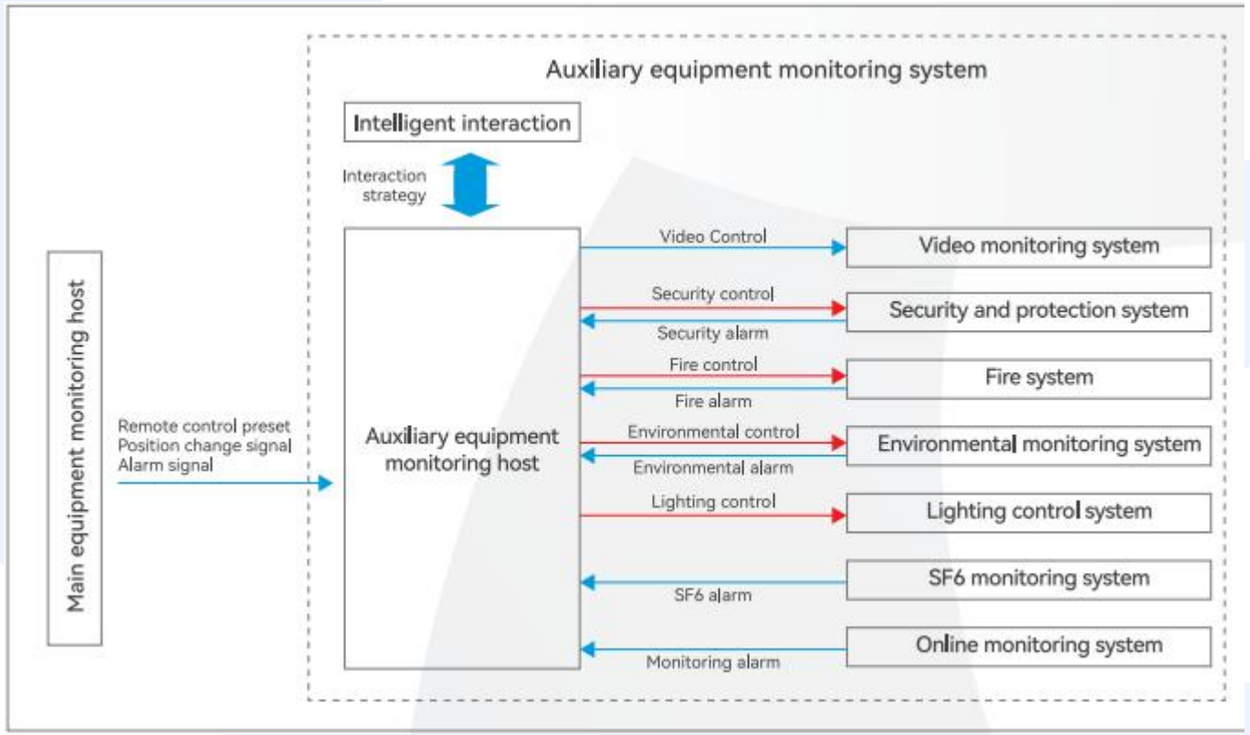
Integrated visual monitoring of auxiliary equipment

- Security prevention intrusion alarm
- Fire alarm
- Environmental monitoring (typhoon, rainstorm, etc.) out of limit alarm
- Facial recognition alarm

Integrated visual monitoring of personnel behavior

- Incorrect wearing of safety helmet
- Personnel falling to the ground
- Fighting and brawling
- Accidentally entering non work areas

(2) Emergency response based on intelligent linkage



Internal priority control of inspection system

Operation priority: Main and auxiliary equipment linkage>Manual operation>Superior system control>Daily inspection tasks

Emergency linkage control of main and auxiliary equipment

- Remote control of primary equipment, linking video preview, recording,
- Main equipment alarm, accident trip linkage video preview, recording,
- ...

Emergency linkage control between auxiliary equipment

- Security prevention intrusion alarm, linked lighting, video recording
- Fire alarm, linked access control, lighting, and fan shutdown
- SF6 monitoring concentration exceeds the limit, linked fan control, video preview
- Facial recognition alarm, linked video preview and recording
- ...

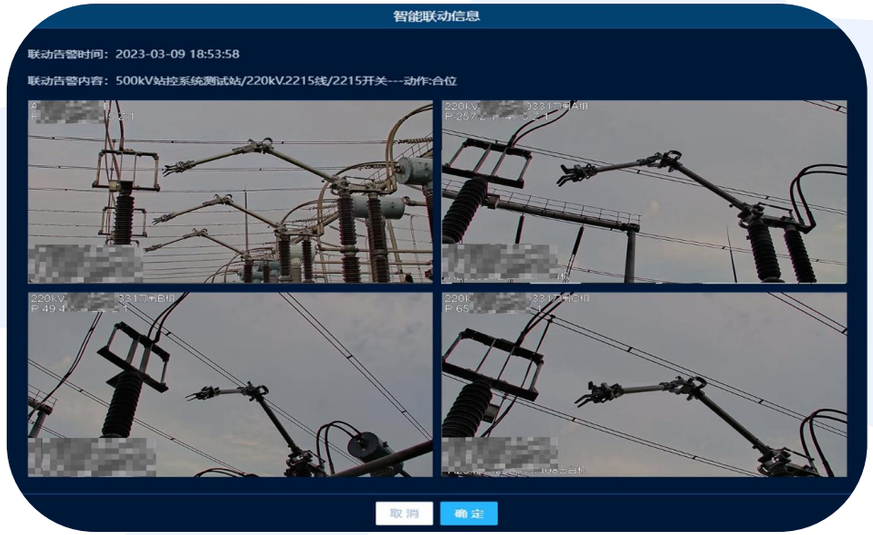
Inspection system triggers emergency reverse control

- Transformer oil level abnormality ->online monitoring of oil chromatography
- Facial recognition through ->access control automatic switch, lighting and illumination
- Personnel intrusion ->lighting, sound and light alarm alarm
- Fire ->Access control door, turn off fan, start water pump
- ...

(1) Visualization of the process of one click sequential control operation

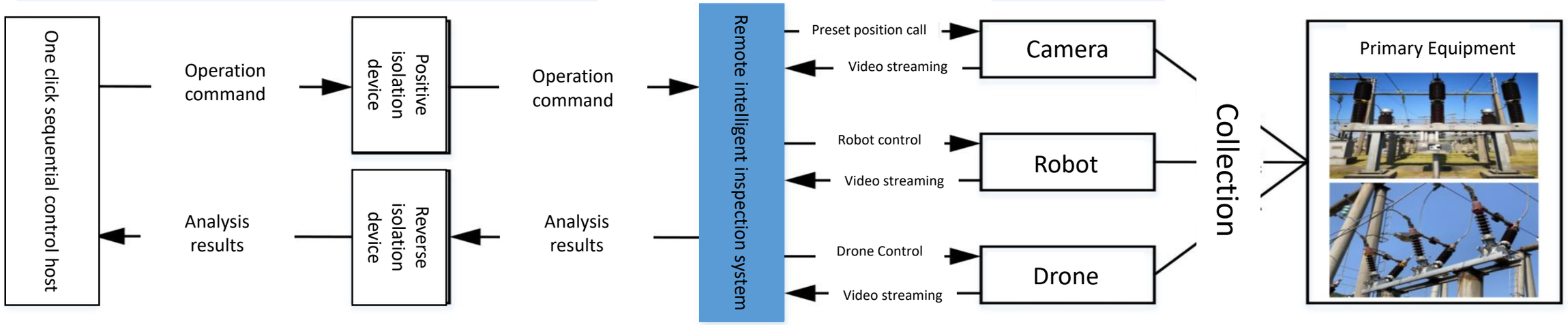
Visualization of operation process

- After receiving the sequential control operation signal, pop-up window will appear
- Visualization of switching process
- Storage sequence control operation video
- Replace manual on-site verification



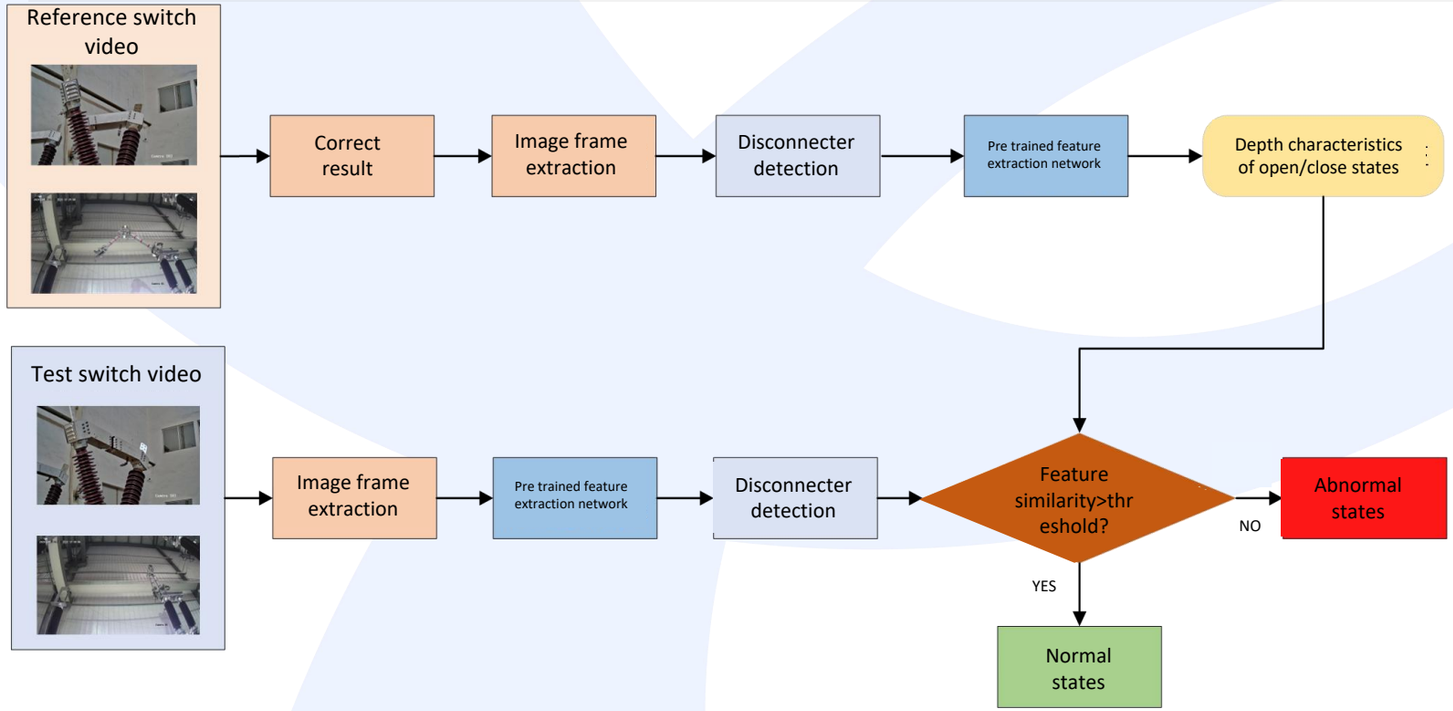
Double confirmation result returned

- Return the non same source auxiliary criterion confirmed in the video to achieve "double confirmation" of the opening and closing positions of the isolation switch



(2)Device state detection based on video frame extraction

- **Reference feature extraction:** Use video frame extraction to extract the beginning and end frames of the reference knife switch video, obtain the reference images of the open and close states, and extract features from the knife switch part
- **Detection process:** Obtain the first and last frames of the test video, extract features from the knife switch part, and determine the similarity between the features and the reference image. If it is greater than the threshold, the opening and closing are normal; otherwise, if it is less than the threshold, the opening and closing are abnormal
- **Optimization direction:** Based on video classification technology, combining image sequences with transformers can directly input videos to obtain the final split state



PART 05

Cases and value

Comprehensive perception of device status

Item	Current situation	Auxiliary equipment monitoring system
Main equipment data	Incomplete monitoring information and limited means	Real time monitoring
Equipment appearance	Manual photography recording	Video/Robot Joint Inspection
Runtime environment	Manual recording	Real time monitoring by sensors
Meter data	Manual transcription	Remote transmission meter, video analysis
Partial discharge monitoring	Artificial live detection	Automatic online monitoring acquisition
Mechanical properties	Artificial live detection	Automatic online monitoring acquisition
Infrared temperature measurement	Artificial live detection	Infrared camera automatic temperature measurement

Value:

- Realize multi-dimensional perception of device status (monitoring data/meters/videos/images), providing solid data support for intelligent analysis and decision-making;
- Enhance the comprehensive monitoring capability of equipment

Remote operation of auxiliary equipment

Item	Current situation	Auxiliary equipment monitoring system
Door opening and closing, lighting control	Manual operation	Remote control
Air conditioning and fan start stop	Manual operation	Remote control
Alarm threshold maintenance	Manual operation Main stations are maintained separately	Remote maintenance, shared synchronization between master and slave stations
Operating parameters Setting	Manual operation	Remote setting

Value:

◆ Remote control of main and auxiliary equipment to reduce the number of round trips to and from the substation.

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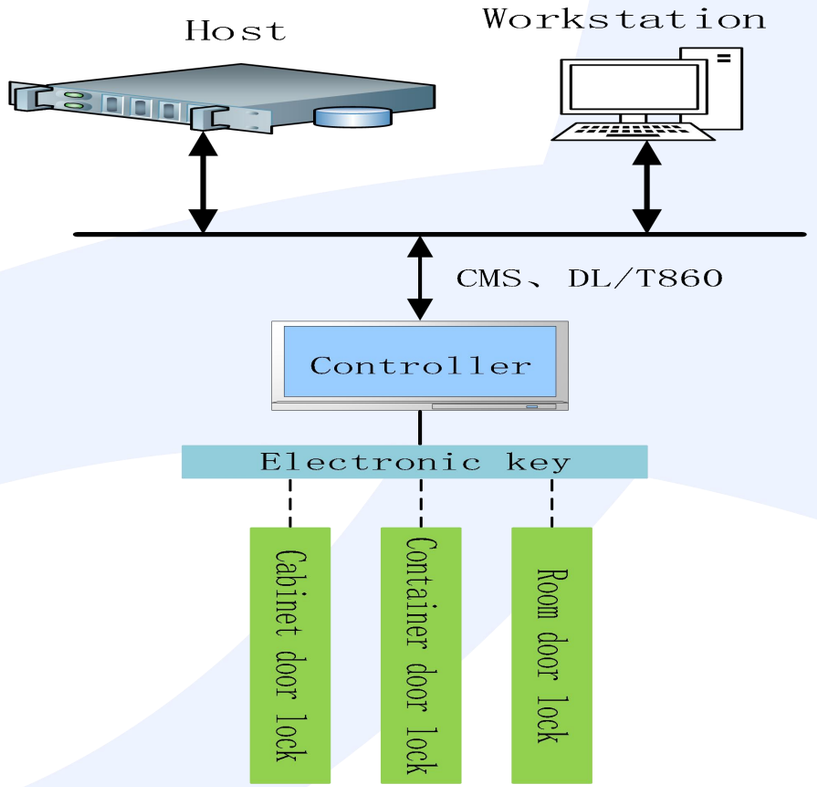
One Key Management

Smart Key One Key Management

The intelligent lock control system consists of a lock control controller, electronic keys, and substation intelligent locks. It replaces various traditional mechanical locks and keys, and has functions such as remote control of unlocking permissions, data-driven storage of unlocking records, and information-based management of unlocking processes.



Core Value

- Electronic management of non error proof locks
- Lock operation can be controlled and recorded

Intelligent linkage for data sharing

Item	Current situation	Intelligent inspection system
Equipment operation	Independent operation, Data island	Data sharing Collaborative cooperation
Fault isolation	Manual on-site operation	Intelligent linkage Timely isolation
Fault confirmation	Manual on-site inspection	Video push Self inspection
Fault handling	Manual analysis、 processing	Linkage control Timely response

Value:

- Collaborative cooperation, intelligent linkage between main and auxiliary equipment, and auxiliary equipment in case of abnormal faults, improves the emergency response speed of defects, and shortens the processing time of defects。

Intelligent inspection

Based on **image intelligent recognition algorithms**, remote joint intelligent inspections are carried out using high-definition videos of substations, robots, drones, voiceprint monitoring devices, etc., to intelligently inspect equipment appearance, equipment defects, etc., achieving machine substitution for humans and improving inspection efficiency.

Machine substitution

Joint inspection

Highly intelligent

Intelligent and efficient machine inspection

Item	Current situation	Intelligent inspection system
Labout	8 hours	7*24 hours
Capacity	Different due to experience	Big data and intelligent analysis
Scope	Equipment appearance, defects that have occurred	Equipment appearance and internal full coverage
Report	Manual entry	One-click generation
Frequency	Once a month	Once a day
Efficiency	Arrive at the site in 1-2 hours	Anytime, wherever you point, wherever you go

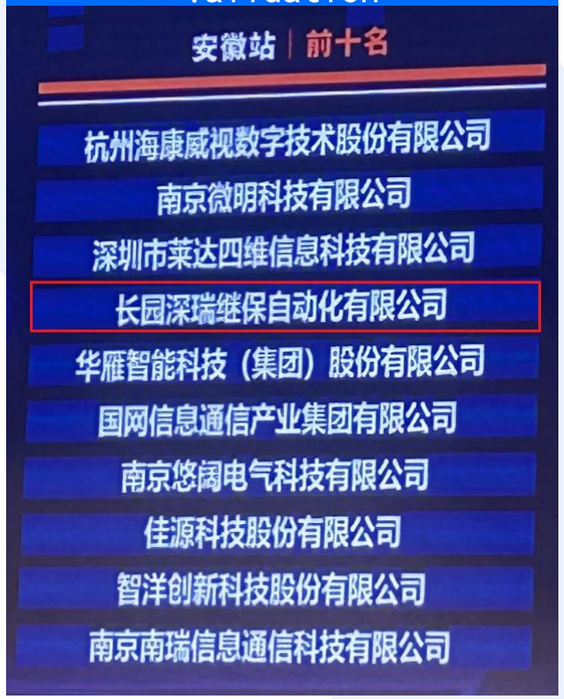
Value:

- Realize **full coverage** automatic inspection, release O&M personnel from a large amount of manual inspection work, greatly **improve inspection efficiency**, and truly realize **unmanned intelligent inspection of substations**.

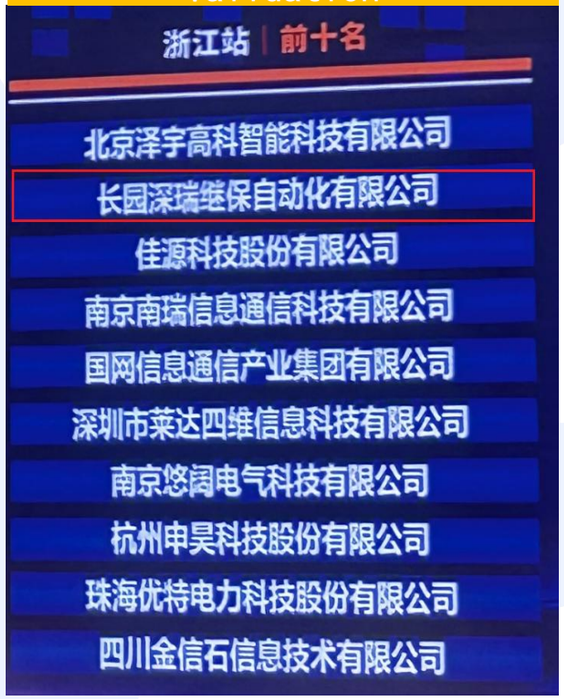
Algorithm Validation Competition

Our company actively participated in the normalization cultivation of intelligent inspection image algorithms for substations organized by the State Grid Equipment Department in 2023, and went through the four algorithm verifications and stood out among them, winning the "Top Ten Comprehensive Verification Teams of the Year".

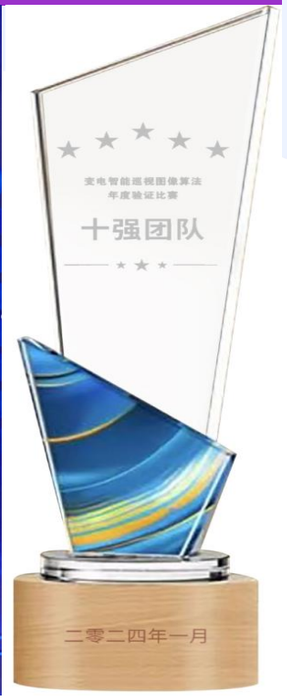
Anhui Station Algorithm Validation



Zhejiang Station Algorithm Validation



Top 10 teams for annual comprehensive verification



Participated in the joint project between State Grid Equipment Department and Digitalization Department to unveil the seed model capability of the 2024 substation intelligent inspection image recognition algorithm

国 家 电 网 有 限 公 司

国网设备部 数字化部关于联合开展 2024 年变电智能巡视图像识别算法种子模型能力提升揭榜挂帅的通知

各算法研发单位：

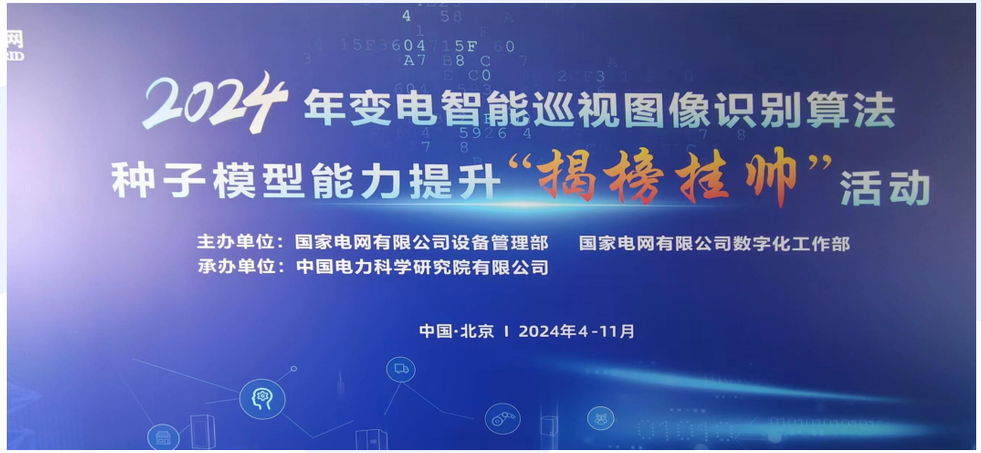
为贯彻落实《关于推进变电专业智能巡视算法提升及实用化应用的通知》和《公司人工智能规模化应用专项行动方案》工作要求，加快提升变电智能巡视实用化水平，国网设备部、数字化部联合开展变电智能巡视种子模型能力提升“揭榜挂帅”活动，具体事项如下。

一、活动目的

聚焦变电智能巡视实用化提升，推进人工智能技术在变电站智能巡视中规模化应用，探索“大模型+专业模型”在变电智能巡视实用化应用，采用“平台+现场”验证模式，开展种子模型能力提升“揭榜挂帅”集中攻关和自主可控硬件适配验证，推进优质算法现场试用和跟踪评估，发掘培育算法研发和实用化综合能力强的单位，突破变电智能巡视图像算法实用化瓶颈。

二、活动原则

公开征集，自愿报名。面向全社会公开征集，畅通参与渠



Test Result

Mean Error	SF6 pressure gauge	Leakage current meter	Oil temperature gauge	Oil level gauge
1.62462%	2.86872%	0.45696%	1.51764%	1.65516%

Judgment criteria

Qualified: The maximum reading error of various meters is ≤± 5%, and the actual reading and average reading error of various meters are also acceptable ≤±2%;

Excellent: The maximum reading error of various meters is ≤± 2% of the actual reading

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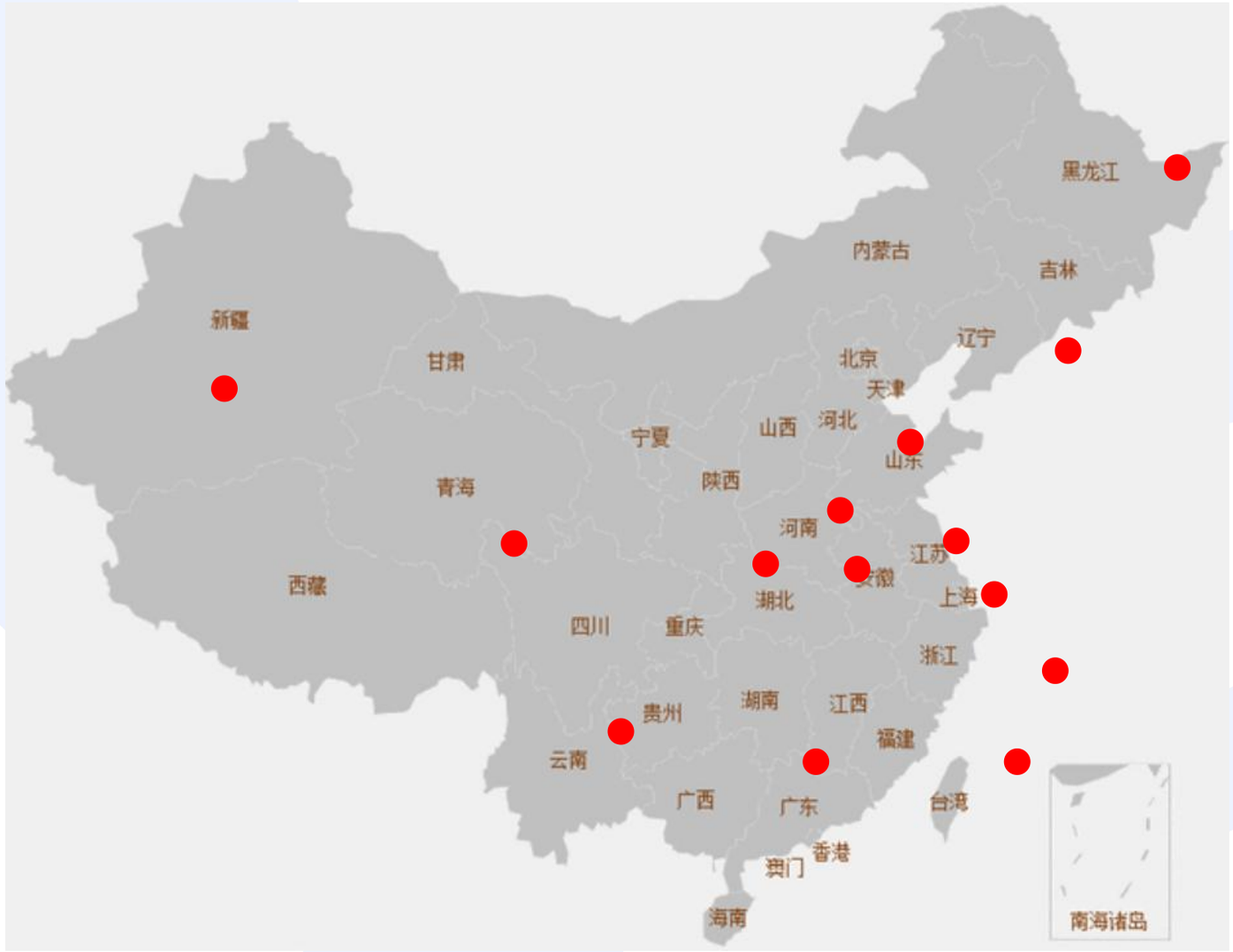
Application Cases



- Zhejiang Jinhua 500kV Pancun Substation Intelligent Auxiliary Control
- Zhejiang Wenzhou 500kV Rui'an Substation Auxiliary System Comprehensive Monitoring Platform
- Hebei Baoxi 500kV Intelligent Substation Auxiliary System Comprehensive Monitoring Platform
- Hunan 110kV Shizishan Smart Substation
- Shandong 220kV Tianping Smart Substation
- Shanghai 220kV Shengxin Station Auxiliary Control System Project
- Qinghai Fuyuan 330kV Substation New Construction Project Auxiliary Control Equipment Project
- Shanxi Jinzhong 220kV Wangyu Substation New Construction Project
- 110kV Xinyuan Intelligent Substation Auxiliary System in Puyang County, Puyang City, Henan Province
- Intelligent Transformation Project of Shaanxi Baoji Mingxing 110kV Substation
- Sichuan Deyang 220kV Wan'an Substation
- ...

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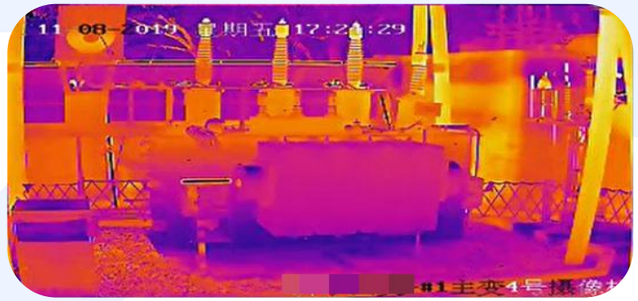
Application Cases

The Hunan 110kV Shizishan Smart Substation project has achieved various functions such as full station video monitoring, intelligent inspection, online temperature measurement, intelligent linkage, and one click sequential control video double confirmation.

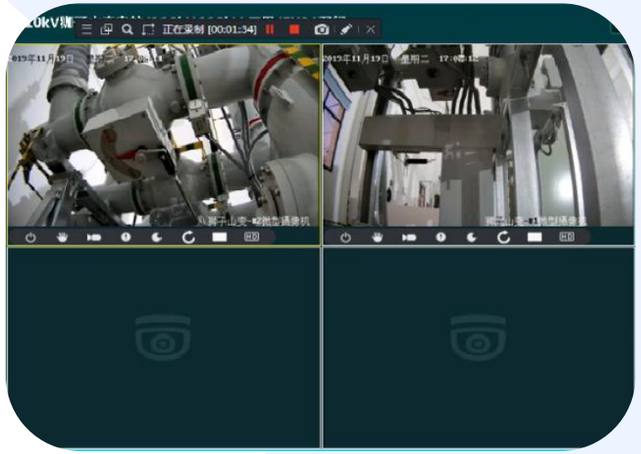
Since the system was put into use in 2019, it has carried out thousands of routine and special inspection tasks, enhancing the ability of operation and maintenance personnel to perceive the status of substations, detect defects, respond to emergencies, and control equipment, effectively reducing the daily inspection work of operation and maintenance personnel, and reducing their workload and increasing efficiency.

Rail mounted robot

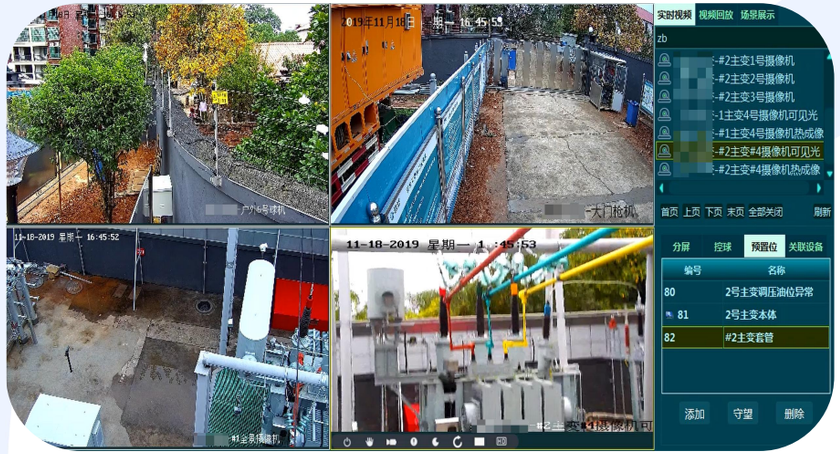


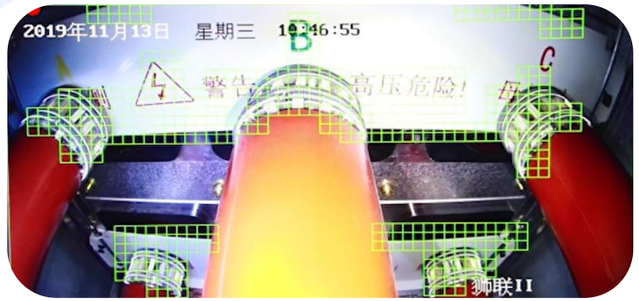
Transformer temperature measurement

Intelligent linkage pop-up window



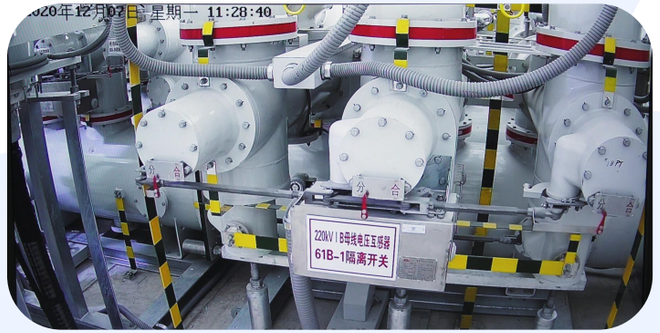
Execution of inspection tasks





Video double confirmation

The Shandong 220kV Tianping Smart Substation project is equipped with 2 track machines and nearly 150 cameras of various types. The entire station covers 7691 inspection points, fully replacing manual routine inspections, light off inspections, and some special inspections. For 14 special inspection tasks, standardized preset points are set, and customized special inspection tasks are activated when specific situations occur to increase inspection frequency and improve equipment control capabilities.



miniature camera

Inspection task configuration

Execution of inspection tasks

GIS room high-definition camera

Protection room track robot

CYG长园 股票代码 600525.SH Stock Code

Thanks !

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