Research on Intelligent Monitoring and Early Warning of Electric Power Safety Based on Artificial Intelligence Technology

Liu Yu, Wang Zuowei, Pan Yingli, Zuo Yue
State Grid Huludao Electric Power Supply Company, China

Abstract: In recent years, with the continuous improvement of the national economic development level, the scale of urban construction in China is also gradually expanding. Therefore, since the monitoring system plays an important role in various industries, the establishment of an intelligent automatic management system can determine the unstable factors in the monitoring management and improve the safety performance of the monitoring system, so that the normal operation of the monitoring platform can be maintained. The establishment and function of the intelligent monitoring and early warning system are analyzed and studied in the paper, which combines traditional video monitoring equipment and data acquisition equipment into one, and launches a monitoring and early warning solution.

1. Introduction
In the modernization construction, various industries are seeking the application of advanced technologies such as automation and intelligence. Taking the power system as an example, when there is no energy management system, it is difficult to fully understand the operation of air-conditioning, water pumps, lighting and other equipment in the building and the consumption of water, electricity, air, and cooling, thus a large plenty of energy is wasted unconsciously, while the energy management system can not only measure various electrical parameters in real time, display and record energy consumption data, but also analyze the load types and trends of energy consumption, finding energy consumption usage problems and proposing targeted optimization suggestions and operating strategies. Moreover, it can find the ideal energy consumption state of the equipment, and reasonably determine the set value of the equipment operating stat to control the start and stop time of the equipment so as to save energy[1-2].

2. System Structure Design
The collection device integrates monitoring equipment, micro-environment, video device and local monitoring, which sends the collected information to the back end of the intelligent online dynamic information platform server and publishes web services in the back end. Users view real-time information online through web access. Moreover, the acquisition device realizes remote control of monitoring equipment and video devices, and saves historical videos. The user sends online or historical videos to the acquisition device through the Web, and the acquisition device sends the video stream to the access client; In addition, the user issues control commands to the acquisition device through the Web to control the video equipment, and local monitoring can directly view the real-time data information and the remote control commands below[3].
3. System Function Realization

According to the technical functions and technical requirements in the construction of the monitoring and management system of the distribution station computer room, the goal is to realize the specific functions. The main functions of the system are shown in Table 1[4].

Table 1. Functions of the monitoring and management system in the power distribution station room

| Function range            | Function item                                                                 |
|---------------------------|-------------------------------------------------------------------------------|
| Security function         | On-site terminal equipment has IC card access control management function      |
|                           | It can field terminal equipment with infrared alarm function                   |
|                           | Field terminal equipment has door magnetic alarm function                      |
|                           | It is with temperature and humidity monitoring and alarm functions             |
|                           | It is with flood monitoring and alarm function                                |
| Environmental monitoring  | It can be connected to a temperature and humidity sensor with LCD display and |
| function                  | backlight and synchronously transmit data to the management platform;         |
|                           | It can connect to smoke and SF6 monitoring and alarm equipment as needed and   |
|                           | transmit data to the management platform simultaneously;                        |
|                           | It can receive the data signal of the transformer control cabinet as needed    |
|                           | and synchronously transmit the data of the transformer control cabinet to the   |
|                           | management platform;                                                          |
|                           | Fans can be installed according to the owner's application needs, and can be   |
|                           | linked with environmental monitoring equipment.                               |
| Alarm function            | On-site terminal equipment can transmit abnormal information on the site such  |
|                           | as personnel swiping card opening information, illegal door opening information,|
|                           | flooding information, high temperature alarm information and humidity alarm     |
|                           | information to the management platform software through the network, which can  |
|                           | be directly sent to the designated personnel’s mobile phone by SMS.            |
| Remote upgrade function   | The software version of the field terminal device can be remotely upgraded     |
| Function                  | through the tool.                                                             |
| Function that authorizes  | The authorized mobile phone can be used to directly open the electric lock of  |
| mobile phone to open the  | the designated distribution station remotely.                                  |
| door remotely             |                                                                                |

4. System Equipment Requirements

Requirements for the construction of monitoring and management system in the power distribution station are:

4.1. Equipment configuration requirements

It is required to configure 1 pan/tilt integrated camera, 1 set of local storage DVR host, 1 1T dedicated hard disk, and products of famous domestic video equipment manufacturers;

4.2. Network features

It is equipped with a wireless networking module, which can directly communicate via wireless 3G/4G. Generally, the network requires that the distribution station does not have a wired network in place. Therefore, the system is required to use wireless network communication. In addition, since many distribution stations are installed in the basement, the on-site terminal equipment of this system is required to make full use of the different network methods at the distribution station site (such as 2G/3G/4G, GSM, CDMA, wired network, etc.);

When the wireless network between the distribution station and the platform is accidentally disconnected, a simple permission setting can also be made through short messages with the distribution station equipment terminal[5].
5. Communication Interface Design

5.1. Communication protocol
The standard communication protocols of the device are: IEC60870-5-101, IEC60870-5-103, IEC60870-5-104, CDT, DISA, MODBUS, DL645 electric meter, etc.

5.2. Data collection
It has the function of data collection.
 According to the device, the corresponding protocol is configured, which can collect the remote measurement, remote signal volume, and remote pulse volume of the device equipment;
 According to the device, the corresponding protocol can be configured, and the device can be remotely controlled and operated.
 Important switch positions in the system can be captured in real time. Meanwhile, alarm signal relay output contact and digital output node can be provided as well.

5.3. Data processing
It can have the function of data processing.
 It can process the collected data and support the analysis of device data;
 It supports the processing of device data, including: the principle of addition, subtraction, multiplication, and division can be used to obtain remote measurement of user needs;
 The principle of OR, AND, and NON can be used to obtain the amount of remote information required by users.

5.4. Remote data transmission
It is with the function of remote data transmission, which can remotely transmit the collected data regularly and support sending data to multiple data centers (servers).

5.5. Video capture
With video capture function, it can manage the network camera, collect the camera video data in real time, and save the historical video data, which can also be forwarded to the background for display, and has the function of PTZ control;
 H.264BP/MP/HP, VC-1SP/MP/AP, MPEG-4SP/ASP except GMC, DivX (Xvid), MPEG-1/2 and other decoding formats are supported.

5.6. Auxiliary tools
System-related configurations are configured through interface-based auxiliary tools, which can view real-time data and communication messages in real time, and manually set device data.

6. System Software Design
In the software design of the intelligent monitoring and management system, there are mainly 5 contents including system module, physical equipment base class, power protocol communication base class, main program DMP6800Main and interface display server interface. The main parameters of each component are shown in Table 2[6-7].

| Main components | Main function | Detailed parameter and function introduction |
|-----------------|--------------|---------------------------------------------|
| System module   | Memory bank  | The memory bank that the telecontrol communication system runs is created when it is first loaded, and the memory bank is released after the last called module exits. Each module accesses, reads and writes the memory bank through the libShareMem.so    |
SO interface of the memory bank.

Physical equipment base class
libDevice.so

The module realizes the functions of opening, closing, reading and writing data to the physical device, and puts the read data in the public buffer.

The power protocol communication base class mainly provides some standard interface function prototypes that implement the protocol, the operation interface of the physical device, and the power data information mapping management interface.

Physical equipment base class
libDevice.so

Power protocol communication base class
libDLPcl.so

Main program
DMP6800Main

Main module

Realize the communication with the configuration interface, and send real-time data to the GDI_C client for users to view real-time telemetry, remote signaling, communication source code, communication messages, etc.

It mainly includes the protocol operation management of the communication system, the extension module call, the realization of the watchdog and so on.

Monitor real-time/historical video playback; playback stop, video control, stop control and other commands; send a video stream to the client or issue a command to the video device after the command; save the historical video stream.

7. Function Realization of Intelligent Monitoring Management System

(1) Realize the remote management of the access control system in the entire power distribution station;

(2) Monitor the infrared security intrusion in real time; real-time monitor and centrally manage environmental status information (temperature, humidity, water level).

(3) With embedded system, remote independent or centralized management can be realized based on B/S architecture (that is, the centralized monitoring center has the highest authority to independently monitor, and authorizes some district-level units to monitor the area at the same time), which is convenient for later software system upgrade and management as well as maintenance.

Under permitted conditions, the system accesses the security and monitoring facilities which are previously constructed according to the agreement.

8. Conclusion

By analyzing the components of the intelligent monitoring and management system, the structure and the realization of the main functions in the intelligent monitoring system are deeply studied. Moreover, with the help of the research in the intelligent monitoring and management system, the system operation status of various industries can be monitored in real time, and the existing problems can be found in time, so that corresponding treatment measures can be taken.

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