Real-time Monitoring Switch Device Based on IoT

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In this paper, we design a switchgear comprehensive on-line monitoring device based on IoT. Monitoring device mainly consists of monitoring unit, control unit and recognition unit. Monitoring unit mainly to access the circuit breaker, bus and contactor temperature monitoring, and sends the monitor data to the switchgear IED. Control unit monitor inside state, and display Switchgear status through the LCD screen, at the same time it realize the control of the switchgear electric operation. Recognition unit using the RFID technology embedded in an equipment of the electronic tag information, for accurate positioning and tracking device. Switchgear IED receiving information of the above units, communicate with service center of the station control layer, realize remote monitoring function.

Keywords: Switchgear; IoT; IED; RFID.

1. Introduction

As an important equipment in the power transmission and distribution system, the switchgear plays an important role in the power transmission line and the monitoring data. The safety and reliability of power equipment is an important link to ensure the security of transmission and distribution and power grid. In this paper, we design a switchgear on-line monitoring device based on IoT(Internet of things), to ensure the normal operation of the switchgear and improve the reliability of power systems and degree of automation operation, thus has a very important significance [1].


The online monitoring device of switchgear based on IoT includes 4 parts, which are monitoring unit, identification unit, control unit and switchgear IED (intelligent electronic equipment). Among them, monitoring unit include mechanical characteristics of monitoring unit, a bus/contact temperature unit of monitoring; recognition unit mainly includes the all kinds of electronic tag information embedded in equipment; The control unit contains control cabinet subunit "Five Anti" lockout control sub-unit; switchgear IED via CAN, ZigBee transmission to communicate with the other units, and make the appropriate processing and algorithm [2]. The overall structure of the schematic diagram shown in figure 1.
2.1. Monitoring unit

2.1.1. Mechanical characteristic monitoring sub unit of circuit breaker

The circuit breaker mechanical characteristic monitoring unit can collect the running state parameters of the circuit breaker in real time, based on the sensor signal directly or through processing data to obtain the required circuit breaker status, and diagnosis the circuit breaker condition. In addition, the monitoring unit also has 2 digital inputs: normally open contact and normally closed contact, through the access circuit breakers normally open and normally closed auxiliary contact judge the switch state [3]. The specific unit block diagram is shown in figure 2.
2.1.2. **Bus and contact temperature monitoring sub unit**

Bus, contact temperature monitoring sub unit installed in the bus, contact arm[4], mainly monitor bus/contact temperature, through the ZigBee wireless communication method to transfer monitor data to switchgear IED. The schematic diagram of the temperature sensor node based on ZigBee network is shown in figure 3.

2.2. **Control unit**

2.2.1. **Cabinet gymnastics control unit**

Monitoring of switchgear gymnastics control unit mainly includes three parts: the first part is monitoring of switch in cabinet and the switch status display signal taken from the auxiliary contact of the first element in the switchgear; the second part is electric operation control of switchgear; the third part is the temperature and
humidity signal inside the switchgear [5]. The specific unit block diagram shown in figure 4.

![Control monitors unit hardware structure](image)

Figure 4. Control monitors unit hardware structure of the cabinet.

### 2.2.2 "Five Anti" lockout control sub-unit

"Five Anti" means, in addition to prevent misclassification, error breaker, the other "four defense" require mandatory locking. Processor control as the core of the locking device, operators need to operate follow certain steps, the controller judges each operation according to the stored program, if done correctly, it sends the correct audible indicator indicates the relevant operation; if wrong, the system will play voice reminder automatically, and unable to carry out the next operation to ensure the safety of person and equipment.

### 2.3. Identification unit

RFID is a non-contact automatic identification technology. The comprehensive monitoring device recognition unit is the use of RFID technology of circuit breaker, cabinet and other equipment information recognition. The circuit breaker, isolating switch, grounding switch, bus, cabinet and other equipment ontology information tag is pre-buried in equipment, through RFID send the information to the monitoring host directly, to locate and track the equipment accurately, and to understand the dynamic information of equipment.

### 2.4. Switchgear IED

Switchgear IED is mainly used to receive each monitoring units data, realizing remote monitoring function. Switchgear IED can be adapted to a variety of
different monitoring units in the switch cabinet, which uses a lot of communication methods to integrate the switchgear, adopt the cable transmission and wireless transmission mode to realize data communication and control between each monitoring unit and the switchgear IED, overcome the strong electric fields in the switchgear, high voltage, high current, strong electromagnetic radiation, high-frequency noise harmonious wave interference problems. Its hardware principle block diagram is shown in figure 5.

3. Comprehensive Monitoring Devices Software Process

The system uses modular, structured design ideas for software design, in order to facilitate the future of the program and the expansion and transplantation of various functional modules. The software program progress chart of the monitoring device is shown in figure 6. The overall process is an infinite loop, each cycle will continue query the state of the state of the switchgear, press and other various input.

4. Conclusion

The proposed based networking technology integrated switchgear cabinet detection means a collection of a plurality of monitoring units, the use of wired communication and wireless communication way will set up a variety of information of the Switchgear, realizing the monitoring and control of the switchgear effectively. The monitoring device of high integration, reliable data transmission, realize the intelligent Switchgear, improve the level of online monitoring, reduce the maintenance workload, improve the reliability of power supply.
References

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Figure 6. Software process.