The Application of On-line Operating System for Preventing from Operation Mistakes based on ZigBee Technology

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Abstract—Currently, off-line defense against the current operating system can not accurately detect the device error status, can not really prevent "walking space" and the construction of complex line against wrong operating system, electromagnetic interference and other drawbacks, the paper offers wireless communication line based on the operating system of error prevention . The system can accurately detect real-time device status, complete "defense away empty", the construction is simple, no interference. The error system of defense for enhancing the safe operation of substations, reducing the complexity of construction of great significance.

Index Terms—zigbee,electric substation,Wireless

I. INTRODUCTION

Anti-misuse device is a switching operation to ensure the safety of important installations. At present, the anti-error device has been in power system has been widely used, its technology matures, increasingly high running stability, security and stability than previous mechanical latch to high. At present, the key operating type of mistake proof device has a construction as simple and reasonable cost, is widely used. But the key operational error prevention device type has its inherent shortcomings, which can not be real-time detection of a device status field, the actual switching operation, because of the state and field equipment caused by misuse incidents do not correspond to occupy a very high percentage. Wrong with the online capabilities of anti-monitoring devices to achieve through the routing network, the high voltage level of anti-interference ability, and on the construction and investment are very difficult, especially in the old station rehabilitation, more is not easy to implement, so the development of a simple construction , and possessed of mistake proof device line features is imperative.

Online Anti-based wireless communication with wireless network communication error operating system, anti-error host through a wireless network directly with each device lock communication, real-time collection device status, according to auto-open closed trajectory simulation, automatic switching operation to achieve.

II. TECHNICAL FEATURES AND ADVANTAGES OF ZIGBEE APPLICATIONS

A. ZigBee technology

Zigbee is a new short-range, low power, low rate, low cost, low complexity, wireless network technology. IEEE 802.15.4 protocol stack based on the establishment of a powerful device with networking capabilities.

Zigbee technology features:

Low power consumption: using a variety of power-saving mode, you can ensure that the two AA batteries continued to work for 6 months to two years, which is Zigbee technology's unique advantages.

And real time: a general delay is 15 ~ 20ms, very suitable for real-time data transmission system.

Reliable communication: using CSMA-CA for collision avoidance mechanism, to avoid sending data, competition and conflict, while a fully recognized MAC layer data transfer mechanism to ensure that each message can be transmitted properly.

Network self-healing, self-organizing ability: without human intervention, automatically establish a connection between the composition of structured network; node increases or decreases, the node position changes, the network can self-repair, automatic adjustment of the topology to ensure that the network correctly.

B. ZigBee technology to prevent misuse of the operating system advantages of online

Online Anti-false state of real-time operating system device spaces, open lock instructions and accurate flow of information security status, such as specific requirements to facilitate additional spacing to determine the system real-time, security, reliability, scalability and energy efficiency requirements.

- Real-time:Zigbee technology equipment, delay the typical search for the 30ms, sleep activation delay as 15ms, activities, equipment, access channel delay is 15ms, fully able to meet the operating error-line anti-deflection from the device to the system diagram refresh-second time requirement.
• Security: Zigbee technology provides data integrity checking and authentication capabilities, using AES-128 encryption algorithm. Each application has the flexibility to determine their safety.

• Reliability: IEEE 802.15.4 physical layer protocol used in direct sequence spread spectrum technique reduces noise, there are clear-channel detection. Using CSMA-CA for collision avoidance mechanism, to avoid sending data, competition and conflict, while a fully recognized MAC layer data transfer mechanism (to send data packets are yet to be confirmed by the receiver, such as the problems were re-issued) to maintain the timely transmission of data packets.

• Scalability: Zigbee network self-healing, self-organized, and increase or decrease the node, the node after the mobile network location can automatically repair, without human intervention. New nodes over the network from the effective coverage area, you can increase the communications relay station by means increased communication range. After the new substation to ensure line spacing to prevent normal operation of the operating system error.

• Energy Conservation: In order to avoid complex routing, line operating system with anti-error "no route" mode, anti-high-performance lithium battery powered lock error. Zigbee technology, low power consumption, to ensure against false lock can continue working for 1 year.

III. SYSTEM DESIGN

A. System components

System error by the anti-host, wireless networks and intelligent anti-lock error component.

Intelligent real-time collection devices against false lock state and lock state, and have wireless communication capabilities.

Wireless network by the communication base station, communications relay station and communication terminal equipment composition, communication area to cover the entire substation.

Anti-error host shows once a main substation wiring diagram, receive device status information and locks status information, real-time device status refresh time to complete the device automatically in real time position; with constrained simulated blocking logic operation function; the simulation trajectory, automatic unlocking device and real-time monitoring of device status, device operating automatically lock in place to complete the switching operation of the automatic control field.

B. Network structure

Network structure of communication base station, communications relay station and the communications terminal equipment (intelligent anti-lock error), with use of star communication structure. Low-voltage substation closed point (a device) a small number, you can use the most simple one star topology (communications relay station is not a layer); high-voltage substation closed point (a device) quantity, you can use 2 stars shape topology.

Figure 1. A star topology map

Figure 2. Two star topology map

C. Intelligent Anti-lock error

Through non-contact mode (sensor mode) collected equipment status and lock status (also can assist the node or light signal acquisition state), and equipment status and write eeprom in the lock state.

Touch screen with LED to show battery power, the current device state and lock state, usually, display a black screen power-saving work in the state, can trigger the display by touching way.

Embedded zigbee wireless communication module, a wireless network device status and lock status reporting.

With the only internal code used to identify a device.

Zigbee technology nodes because of the characteristics of high-performance lithium battery lock as a working power supply, to ensure against false lock at least 2 years of work, easy battery replacement.

D. Power Design

Communication base station normally uses 220V AC power, in the case of site-wide power outage, using rechargeable lithium battery-powered, with automatic switching power supply function, while in the AC power supply to charge the battery.
Communications relay station powered by a rechargeable lithium battery by solar panel to charge the battery.

Anti-lock by mistake battery, a power management features, automatic detection of battery power, you can easily replace the battery.

IV. SYSTEM IMPLEMENTATION

A. Real-time blocking logic to judge

System supports custom functionality blocking logic formulas, the definition for each device division and operating conditions. Analog operation, the automatic locking device for each logical judgments; scene switching operation, the equipment is again blocking logic to judge the former, there are devices to detect changes in position, was again the scene of the ongoing operation of the equipment blocking logic to judge. Once the presence of illegal blocking logic of the situation, immediately closed the current operation of equipment, stop the current operation task. To avoid the process of switching operation due to equipment malfunction caused by misuse.

B. State real-time position

Intelligent anti-lock time error reporting status information through a wireless network, information contained in the internal lock code, device status, lock status and battery power. Anti-error code to determine a host according to the internal equipment, complete equipment status of the position, a system diagram refresh and lock state record.

C. Unconditional lock

Real-time detection system lock state, lock state and do not belong on in the current operation of the device automatically locking the scene. Unlock the key to enable the operation to avoid forgetting to latch caused by misuse.

D. Anti-false self-diagnosis device

Anti-error host and all the anti-lock to keep regular communication error, according to the report of the controller abnormal communication of information in a timely manner to ensure the system failure was found in advance and take preventive treatment measures, to avoid affecting the normal operation to ensure system reliability.

E. Low battery warning

Anti-lock time error reporting status information, which includes the battery. In the battery power falls below a certain value, through anti-false alarm host voice and low power devices show reports, prompts the user to change the batteries.

F. Process control switch operation

System in accordance with the simulated operation of the order of recording equipment and operating methods, operating tasks into the scene, the first operation of equipment to obtain the corresponding intelligent anti-lock internal error code, unlock commands sent by radio (including the lock code and instructions within the state), Smart Lock after receiving packets than the internal coding, is its own code unlock operation is completed.

Time under the anti-lock system error reporting device status information to judge the state lock, unlock time after the success of the state into the device detection process, the operation of equipment in place to detect, send lock instruction, latch onto the next operation of equipment after the success of control flow, in turn, until all equipment is completed.

V. SUMMARY

Anti-based wireless communication line construction of a simple operating system error, a real-time monitoring of equipment status and lock status, to achieve an online automatic block control solution. Simplifies the steps substation operators, device status in real time to solve the problem place, avoiding the difficulties of wiring complexity, the complete elimination of the "walking space" caused by misuse, to ensure the safe operation of power supply system also increased the number of substations construction, increase the automation level of operation and management.

REFERENCES


PROFILE

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