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New Contact Network Maintenance Ground Line Setting

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ABSTRACT. *In the contact network maintenance, it can ensure the normal connection of the grounding wire, and timely dismantling is the primary prerequisite for ensuring the safety of maintenance personnel and equipment. In this paper, an on-line detection device for grounding wire working state based on GPRS technology is designed. The photoelectric switch and video image are used to collect the working state of the grounding wire. The SIM300 module is used to transmit different state information of the grounding wire to the dispatching center. The system software and hardware design is completed, and finally the ground line working state image data and short message transmission are effectively realized.*

KEYWORDS: *contact network; Overhaul; Ground wire*

1. Introduction

The contact network is responsible for the important task of directly transferring the electrical energy obtained from the traction substation to the electric locomotive. Since the contact net is set in the open air, there is no backup, and the load on the line moves and changes along the contact line as the electric locomotive runs[1]. Therefore, it is required that the contact network can ensure the good supply of electric locomotive electric energy under any conditions, and ensure the safe and high-speed operation of the electric locomotive on the line, so daily maintenance work is indispensable. Hanging the grounding wire is a vital part of the maintenance work of the catenary system. In the catenary system, the overhaul work is by manual contact with the ESC through the telephone. According to the determined power outage point, the ESC performs an online power outage. When the operator hangs the grounding wire and starts the online operation, the grounding wire is removed, the ESC is reported, and the ESC is powered to restore the system. In this maintenance operation, the main reason is the operation ticket system and the degree of execution of the operating procedures by the field operators, so there is the possibility of loopholes and misoperations. In the course of the operation, an accident caused by an electric shock burned by an operator may occur 2[2]. A new type of contact network maintenance operation device can be studied, which can be used when hanging the grounding wire and removing the grounding wire. The live

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staff is audible and lighted and can be sent via GPRS to the dispatch, traction substation and where it needs to be transported. The device can solve the problems existing in the current electrical misoperation, and can eliminate the personal and equipment accidents caused by the two misoperations of the live grounding wire and the grounding wire breaker.

2. Hardware system design

Taking into account the actual situation of the field work. The device needs to be attached to the insulating rod of the grounding wire to facilitate the collection of the grounding wire. Because there is no other object in contact with the online party except the contact line[3]. Moreover, there is a possibility that there is residual voltage on the contact line when the grounding wire is disconnected and the grounding wire is removed. Therefore, it is difficult for a general sensor to accurately acquire signals due to the influence of electromagnetic interference.

The signal acquisition of the grounding wire state utilizes the diffuse reflection power-off switch. When the contact wire is stuck in the card slot of the grounding wire, the output level is high, and the grounding wire is considered to be hung: otherwise, the grounding wire is not considered Hang up. This signal can be transmitted not only to GPRS via GPRS, but also to traction. The operator can also be alerted to live audio or light signals. At the same time, the camera is added to the device for video capture, and the on-site operation status is timely reflected to the dispatch. It is convenient to schedule and master the maintenance work. Greatly improve the reliability of safe work[4].

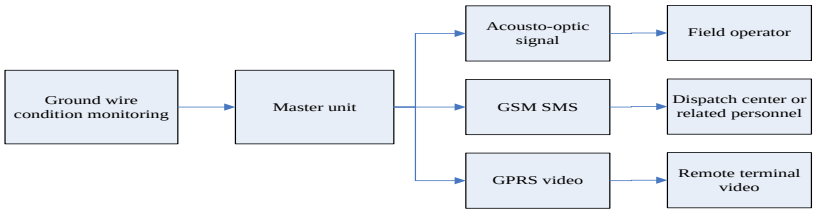

Figure.1 Schematic Diagram of the Device Structure

(1) On-site alarm signal: The main function of the on-site alarm signal is that when the device detects that the grounding wire has been hung, it prompts the field operator that the grounding wire has been hung. Otherwise, the reason is that the on-site workers do not strictly follow the operating procedures, which can effectively avoid personal injury or equipment damage caused by improper operation or misoperation.

(2) Short message and video: Both operations are transmitted to the dispatch center and the traction by wireless transmission. Video information is information transmitted in real time. The device is turned off from the start of the inspection

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operation to the end of the inspection operation, and the short message is sent to the dispatch center or the traction change only when the ground wire is hung or removed. The increase of video information can make the whole monitoring system more reliable, effectively eliminate the accidents that the sensor can send wrong information, make the information channel of remote monitoring and scheduling more abundant, and more intuitively understand the operation of the site. It is convenient to properly monitor and schedule the entire operation.

3. Communication mode selection to achieve design

When the line is inspected for the contact network, multiple sets of grounding lines are often carried out at the same time. The hanging position of the grounding line is generally scattered, and the working time is not fixed. The geographical dispersion determines that the coverage of the communication system is large. If the working time is not fixed, the communication mode of the system can be flexibly set up and quickly enter the working state. The GPRS propagation method satisfies the above requirements very well, and from the research in recent years, the GPRS propagation mode has been applied in real-time monitoring in various industries.

GPRS is called general packet radio service. It is a new high-speed data service introduced in the GSM evolution process to provide GSM users with data services in packet form. It has the characteristics of wide coverage, high efficiency and low cost. It combines mobile communication technology and IP technology to form a mobile IP network. Can be seamlessly connected with a fast-developing fixed IP network. Provide high-speed wireless IP or x.25 services to mobile users. GPRS adopts packet switching technology, each user can occupy multiple wireless channels at the same time, and the same wireless channel can be shared by multiple users, and resources are effectively utilized. The data transmission rate is up to 160Kps, using GPRS technology to achieve data packet transmission and reception, the user is always online and according to the flow rate. Greatly reduced service costs.

3.1 Communication Module Hardware Composition

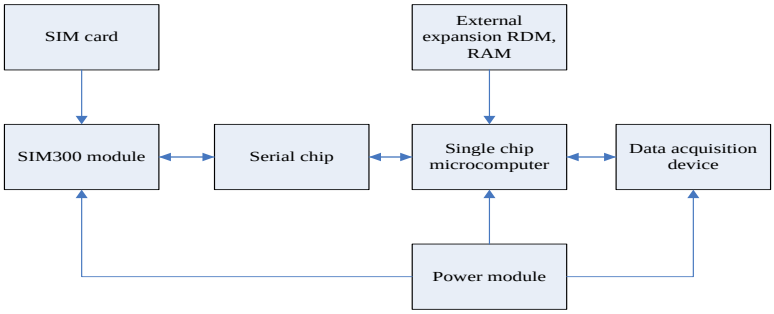

Figure.2 Communication Module Hardware Schematic

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(1) Sim300 Module

The SIM300 module is a GSM/GPRS communication product developed by Simcom, embedded with a powerful TCP/IP protocol stack for high-speed transmission of voice, SMS, data and fax information. After the module is powered on, it automatically attaches to the GPRS network and establishes a communication link with the data center. Send and receive data from remote online monitoring devices and control centers at any time[5].

(2) Serial Chip

Because the serial communication between the SIM300 module and the microcontroller requires a serial port chip for data exchange. We chose SP3238ECA here.

(3) Cpu Processing Unit

This system uses AT89S52, an 8-bit high-performance CMOS microcontroller manufactured by Atmel, with 8K in-system programmable F1ash memory. This unit includes the minimum system, clock circuit, reset circuit and other parts of the AT89S52 microcontroller.

(4) Video Capture

The video monitoring module includes a camera, a video collection unit, an image compression processing unit, a data transmission unit, and a user terminal. After the video image captured by the camera is compressed and encoded, the wireless MODEM passes through the telecommunication GPRS network. Send to the telecom GPRS server. Observers can be away from the scene. Real-time video images of the scene are obtained from the GPRS server through the Internet using special software on the computer to understand the operation situation on the spot.

3.2 Communication Module Software Design

(1) Short Message

SMS (Short Message Service) is a service provided by GSM that does not require end-to-end connection. It is the simplest and most convenient way to communicate data in GSM. The short message is stored and forwarded by the short message center, and the Chinese and English information exchange is performed between the mobile phones. There are three ways to send and receive SMS messages: Block Mode, Text Mode and PDU Mode. Among them PDU Mode is supported by all mobile phones. Any character set can be used. It is also the default encoding method for mobile phones.

Another focus of short message software design is to ensure the reliability of data transmission. Data transmission reliability is an important prerequisite for the normal operation of the device. At present, three aspects are mainly considered: preventing data errors caused by various electromagnetic interferences of the interface circuit itself: preventing interference caused by other abnormal SMS

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contents to the entire system: preventing the short message transmission failure when the network is busy.

(2) Video Image

The image acquisition program is used to control, capture, and save the image scanned by the image sensor. Since the design uses a digital sensor chip, the signal of the sensor chip can be directly controlled. Since only one frame of image is acquired, the monitoring of the frame is only required once. The image compression program mainly uses the JPEG (Joint Photographic Expert Group) compression method because it has a large compression ratio and a small visual distortion. The algorithm is relatively easy to implement and is an international standard for still image compression.

4. Conclusion

This device uses the GPRS transmission method. The ground detection of the contact network maintenance operation can achieve the purpose of real-time online monitoring, and can effectively avoid the safety hazard caused by improper operation in the actual process. A photoelectric switch is used to detect the state of the ground wire. At the same time, there are video images online monitoring, which can effectively avoid false positive information caused by excessive electromagnetic interference on site. The device can effectively ensure the safety of the contact network maintenance work, prevent personal injury and economic loss caused by improper operation, and bring convenience and safety to the on-site maintenance work.

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