

Application Research on Intelligent Management System of Miner's Lamp Charging Rack

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Abstract: *This paper introduces the application status of miner's lamp charging rack, improves the existing system, and designs a new intelligent management system of miner's lamp charging rack.*

Keywords: *lamp charging rack, intelligent system, safety of coal mine production*

1. Setting

The mine lamp is an indispensable lighting equipment for miners in the underground operation. The daily maintenance of the mine lamp is closely related to the safety of the miners. In recent years, with the increasing attention of the state to the underground safety, coal mine equipment manufacturers have begun to explore how to combine the new disciplines with the traditional centralized power supply charging frame, and more effectively manage the mine lamp [1]. At present, some key technologies have been breakthrough, and the intelligent management system of charging frame of mine lamp which introduces communication and computer technology is becoming more and more popular.

The remarkable advantage of the intelligent management system of miner's lamp charging rack is that it can-not only charge miner's lamp, but also establish the corresponding relationship between Miner and charging position, detect the charging status and service life overrun management of each miner's lamp, so as to remind miner to charge or replace miner's lamp on time. Through the data analysis of collected charging information, it can also provide the functions of warning of time out of the well, personnel attendance management, query and printing report, which has a positive auxiliary effect on ensuring the safety of coal mine production [2].

2. Application Status

At present, the main problems of charging rack intelligent management system in the market are as follows:

2.1. The Offline Storage of Personnel Information

The current mainstream charging rack intelligent management system stores the personnel data information in the upper computer server database. Every time the charging rack is powered on, all personnel information needs to be re distributed to the corresponding charging bit terminal controller in turn. On the one hand, the initialization time is long, and the system generally needs to be powered on for 5-10 minutes before it can work normally; on the other hand, when the upper computer or communication line fails, it will lead to the failure to transmit personnel information and data, thus making the whole system completely paralyzed and unable to work normally [3].

2.2. The Problem of User-Defined Setting of Important Parameters

The traditional method is to configure a toggle switch in the charging rack controller and the charging bit terminal controller to set the address code. For the inspection cycle, photosensitive threshold, debugging status and other parameters hard coded in the program code, when the parameters need to be adjusted according to the actual situation, it is necessary to modify the program, recompile and download it to the MCU, which increases the difficulty of system maintenance [4].

2.3. The Multi-Point Access Problem of Operation Interface

Most of the upper computer software of charging rack intelligent management system adopts the C/S architecture. A computer must be selected as the main control computer to install the client software. The management personnel can carry out various operations through the interface provided by the client software. This way limits the office location, and the management personnel can-not timely understand the operation of the system when they go out [5].

In view of the above problems, this paper designs a charging rack intelligent management system which has the main function characteristics of the same kind of products, and can work normally under offline state, can set equipment parameters flexibly and make the management personnel operate and maintain the computer without system software.

3. Technical Content

The intelligent management system of miner's lamp charging rack designed in this paper is divided into three levels: upper computer management software, charging rack controller and charging position controller. The upper computer communicates with multiple charging rack controllers, and the charging rack controller communicates with multiple charging position controllers. The overall framework of the system is as follows:

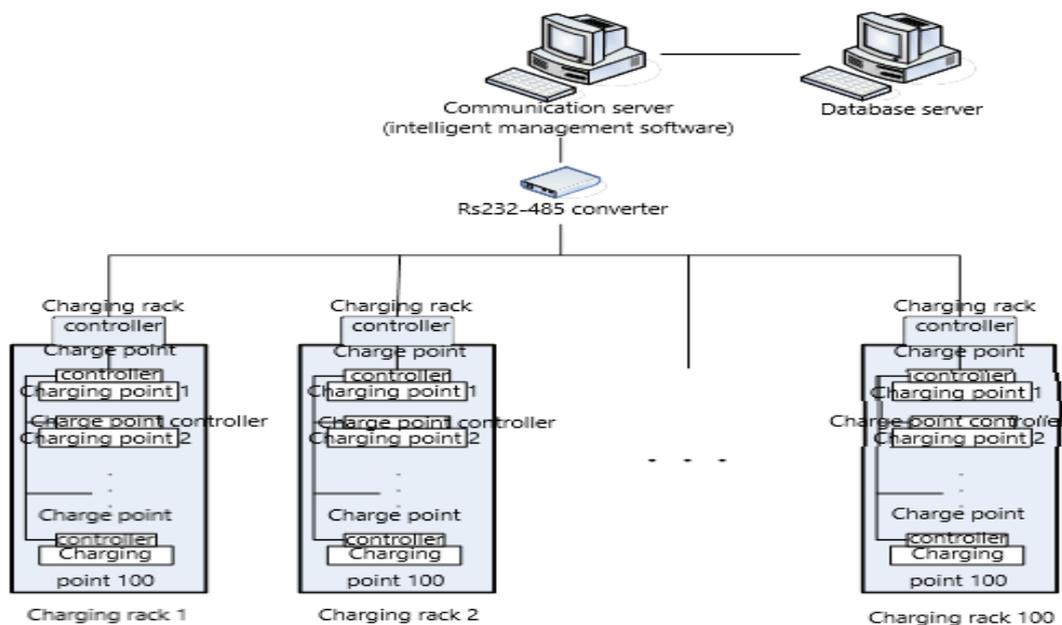


Figure 1: The overall framework of the system

The functions provided by the upper computer management software include:

- Collect the charging status of all charging points through each charging rack, and display the real-time charging status and corresponding personnel information of each miner's lamp on the computer, mobile phone and other terminal devices.
- Set the basic information of miner's lamp (manufacturer, starting time, maximum use times, maximum cumulative use time).
- Set the miner's basic information (name, Department, type of work, contact information, corresponding charge point number, etc.) and send the relevant information to the corresponding charge point controller.
- When the miner goes down the well for a time-out, an alarm message is given.
- Give warning information before the service life of miner's lamp is expired.
- Query the basic information of miners and daily attendance statistics, and print the report.
- The functions provided by the charging rack controller include:

- Regularly scan the charging status of all charging positions on the charging rack (the inspection cycle is less than 30s), and report to the upper computer.
- Receive the personnel basic information from the upper computer, and transmit it to the corresponding charge level controller.
- Count the charging rack status of all charging points on the charging rack, and display it on the LED dot matrix screen) 4. Set the address code, inspection cycle and other important parameters through infrared remote control.
- The functions provided by the charge level controller include:
 - Display the basic information (name, Department, type of work) of the employee corresponding to the charging potential on the 12864 LCD small screen.
 - Collect the charging status of miner's lamp in real time, and display the current status in the form of graphics and text on 12864 LCD small screen.
 - Receive the corresponding employee information of the charging rack transmitted by the upper computer through the charging rack controller, and be able to make persistent storage and update.
 - Judge whether the charging position panel is opened by the change of the resistance value of the photosensitive resistor. If the panel is opened, turn on the LED light in the charging position box for lighting.
 - Important parameters such as address code and photosensitive threshold can be set by infrared remote control.

4. Conclusions

Compared with the similar products in the market, the intelligent management system of miner's lamp charging rack designed in this paper has the following originality:

- The charge position controller has the function of data storage, and can automatically load the miner information when power is on, so that each charging rack can work normally under offline state.
- The infrared control system is developed. Through the universal infrared remote controller, the important parameters such as the address code and inspection period of the charge rack controller and charging bit controller can be set by the user.
- The upper computer management software adopts the b/s and c/s hybrid architecture, which makes the managers no longer limited to specific office places, and can access the system through browser in any place connected to the network.

References

- [1] Tian Xiufang. *Research and application of intelligent charging management system for miner's lamp in coal mine* [J]. *Jiangxi chemical industry*, 2020 (01): 156-157.
- [2] Yuan Peng. *Design of intelligent charging rack for intrinsically safe miner's lamp* [J]. *Mechanical management development*, 2019,34 (07): 66-67.
- [3] Li Na. *Research on communication system of intelligent miner's lamp charging rack* [J]. *Mechanical management development*, 2017,32 (10): 112-113 + 123.
- [4] Liu Bing. *Preliminary study on miner's lamp intelligent charging monitoring and management system* [J]. *Shandong coal technology*, 2017 (02): 125-126 + 129.
- [5] Zhu Shuchuan, Chen Dianxing, Wang Qianzhi, Wei Lanlei, Huang Hesong. *Design of an intelligent charging management system for miner's lamp* [J]. *Coal mine safety*, 2015,46 (07): 123-126.