Online Display System for Key Parameters of Aluminum Electrolysis Cells

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Abstract

The parameters such as voltage and control status in the aluminum electrolysis production process are important indicators of the operation status of the electrolytic cell, which are not only related to the stability of production, but also closely related to production safety. Due to the complex environment of the electrolysis potroom, it is impossible to observe key information about the operation status of the electrolysis cell on multiple inspection screens, which not only brings great inconvenience to production and management, but also poses certain safety hazards to operators near the electrolysis cell. In response to this issue, China Aluminum Zhengzhou Nonferrous Metals Research Institute has developed an online display system for key parameters of aluminum electrolysis cells. The system utilizes advanced microprocessors and Internet of Things (IoT) technology, including three major modules: digital communication, online measurement, and multi-dimensional display. The communication module can be connected to the electrolytic cell control system or other digital systems through fieldbus or General packet radio service (GPRS) network to obtain critical information on the operation of the electrolytic cell. The online measurement module can perform multi-channel analog data acquisition, achieving high-precision and high-speed acquisition of various electrolytic cell states; The multi-dimensional display module uses high brightness large digital tubes and three-color sound and light alarm lights to ensure that on-site personnel can clearly observe the display content from all angles of the electrolytic cell. This system utilizes information technology to achieve digital and intelligent monitoring of electrolytic cell safety, which is of great significance for improving inspection efficiency, reducing labor intensity, ensuring the safety of the potlines, and avoiding economic losses for smelters.

Keywords: Aluminum reduction cell, Cell safety, Internet of Things (IOT).

1. Introduction

The voltage, current, current distribution, flue gas flow rate, anode raising action and other key parameters of the electrolytic cell during the aluminum electrolysis production process not only characterize the current operating status of the electrolytic cell, but also are important parameters for the production safety of the electrolytic cell. However, in production, due to limitations in the space of the electrolysis plant and the size of the electrolysis pot, these key parameters can only

be observed on computers near the control box or within the local area network, which brings great inconvenience to on-site inspections and operators. Especially during operations such as aluminum production, pole replacement, and beam raising, a dedicated person is required to be on duty next to the control box to observe the status of the electrolytic cell and assist manual operations. The project team has developed an online detection and display system for key parameters of aluminum electrolysis pots to address the aforementioned issues. The entire system includes three major modules: digital communication, online measurement, and multi-dimensional display. The digital communication module includes two types of data interfaces: wired and wireless. On the one hand, the collected data is uploaded to the cloud, and on the other hand, it can be connected to other control and detection systems on site; The online measurement module uses high-precision and highly AD conversion chips to achieve multi-channel analog and digital signal acquisition, which can collect various electrolytic cell state parameters including voltage, current distribution, flue gas temperature, bus position, anode action, etc. Multidimensional display includes on-site and remote displays. On the one hand, high brightness large digital tubes and three-color sound and light alarm lights are used for on-site display, and on the other hand, remote access can be achieved through computers and mobile phones. The system utilizes electronic information technology to achieve multi-dimensional display of important parameters of electrolytic cells.

2. Network Architecture of Online Display System

After the online display system completes the collection of single slot information, the IOT module is used to send the data to the cloud server through GPRS network, and other network devices can access the cloud server through the Internet for remote observation. Figure 1 shows the network structure diagram.

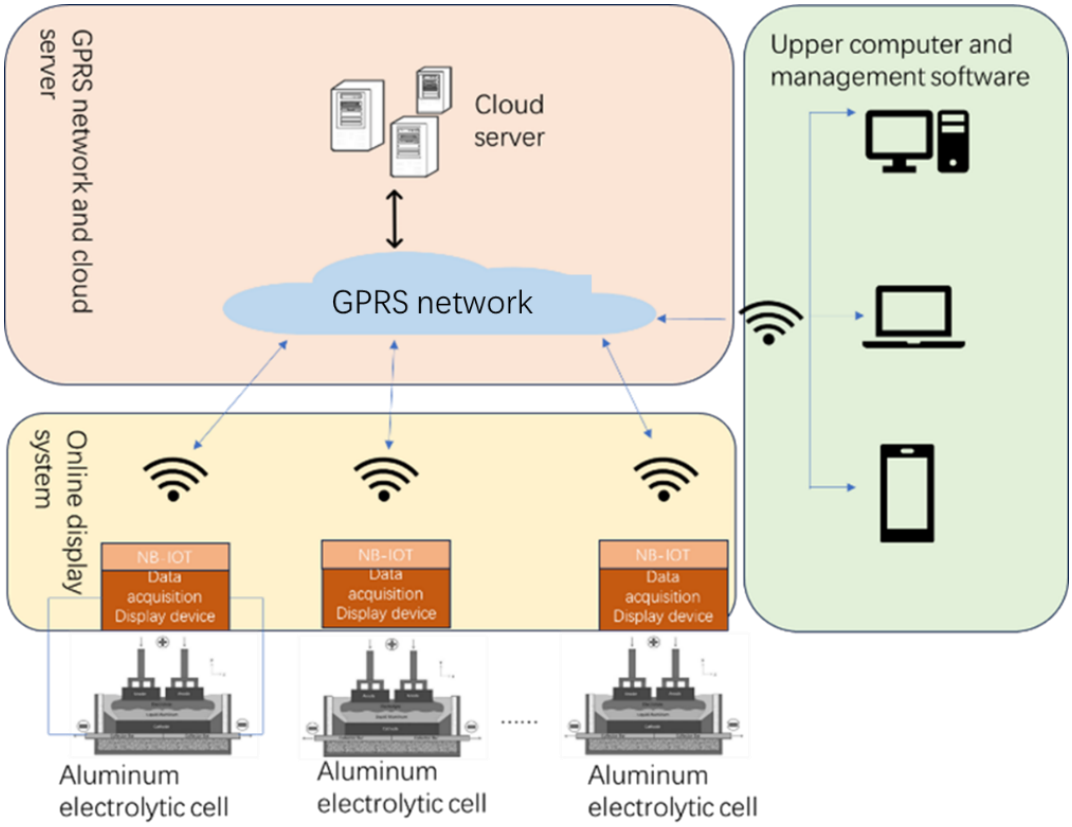

Figure 1. Network structure diagram.

the trend of anode effect in the electrolytic cell as early as possible through the system, handle it in advance, and effectively suppress the probability and duration of anode effect occurrence; After being put into use, the working voltage difference (set voltage) of the electrolytic cell decreased by 1.35 mV, the oscillation time of the electrolytic cell decreased by 45.5 seconds per cell day, and the electrolytic noise decreased by 4.25 mV per cell day. This indicates that the system plays an important role in helping on-site managers detect abnormalities in the electrolytic cell as early as possible, inspect and handle them in advance, avoid the deterioration of abnormalities, improve the stability of the electrolytic cell, save energy and reduce consumption, and improve current efficiency.

8. Conclusions

This system utilizes information technology to achieve online collection, local display, and real-time uploading of key parameters of electrolytic cells; The system does not require additional power supply lines and directly utilizes the voltage of the electrolytic cell as the input power source, making it easy to install; Internally extended fieldbus interface for easy connection with other instruments and digital systems. This system is beneficial for improving the efficiency of cell inspection, reducing labor intensity, ensuring the safety of the electrolytic cell series, avoiding production accidents, and is of great significance to electrolytic production.

9. References

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