

# Crane Remote Monitoring and Maintenance System based on OpenVPN Technology

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## Abstract

This article mainly introduces a crane remote monitoring and maintenance system based on OpenVPN technology. The system uses PLC as the on-site data acquisition and processing unit. The WinCC configuration software uses OPC to communicate with the on-site PLC to archive crane operating data. To the built-in SQL database, and upload the data to the cloud server through OpenVPN technology, and finally use the Java programming language to develop the remote monitoring platform software to realize the remote monitoring and maintenance of the crane.

## Keywords

OpenVPN; WinCC Configuration Software; Remote Monitoring.

## 1. Introduction

At present, most of the fault diagnosis and maintenance of lifting equipment require after-sales personnel to go to the scene to complete. Many equipment failures are caused by operator errors or software failures, and during the maintenance process, maintenance personnel cannot determine the failure point of the equipment at the beginning, resulting in multiple rounds of after-sales personnel, which not only greatly increases the company's after-sales maintenance cost, It also greatly reduces the production efficiency of enterprises, so the remote diagnosis and maintenance of mechanical equipment is valued by more and more manufacturers.

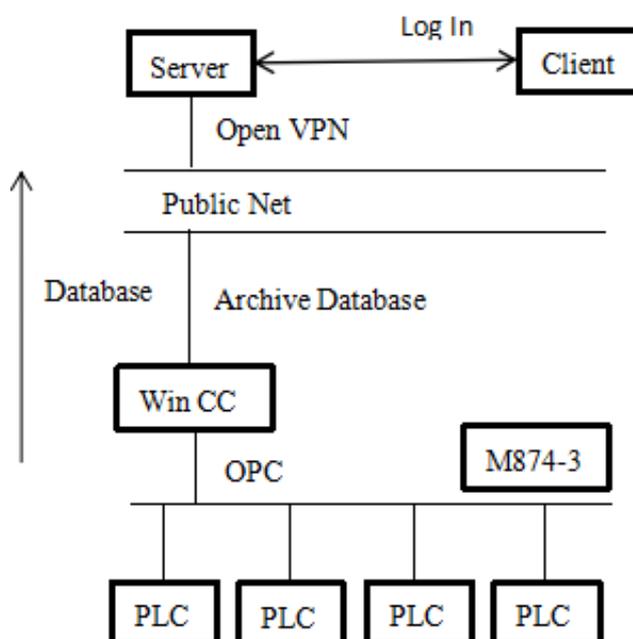


Figure 1. Overall network architecture

## 2. Overall system design

The crane remote monitoring system designed in this paper includes client, router, server, PLC, WinCC, M874-3, and remote monitoring platform software. The system uses OPC technology to realize on-site data communication and Open VPN technology for data transmission. The system architecture is shown in the figure As shown in 1, it mainly realizes remote communication, online programming, real-time monitoring, historical data query, equipment early warning, equipment maintenance, etc. to PLC equipment.

### 2.1 Realization of PLC remote communication function

The system uses Siemens M874-3 to realize remote communication and online programming functions for PLC equipment. M874-3 is connected to the on-site PLC. After the router, client and server establish an OpenVPN connection, users can access through the PC client in any way After the Internet, you can access the system at any time to maintain the connected devices below. That is, configure the router to the server through its IP address to establish a connection. When creating the client, use the server's IP address and the previously assigned user name and password, so that the PC can access the WAN in any way, and you can directly establish an OpenVPN connection with the SINEMA RC server.

After the client establishes an OpenVPN connection with the server, the PC can directly maintain the connected equipment under M874-3, and can remotely access the system to communicate with the on-site PLC through the corresponding engineering software such as Step7, TIA, etc., to realize online programming and remote upload, Download PLC program function.

### 2.2 Crane operation data collection and local archiving

The system uses PLC as the field data acquisition and processing unit. The Win CC configuration software uses OPC to communicate with the field PLC and archives the crane operating data to its own SQL database.

SIMATIC WinCC is Siemens' Windows control center configuration software. It has the complete functions of the SCADA system and the human machine interface (HMI) system. It also provides powerful functions such as OPC data communication and script programming. Users can use the Windows operating system Run and use WinCC. SIMATIC WinCC has the technical characteristics of seamless integration between the automation control system and the configuration software [1]. WinCC uses the Microsoft SQL Server database, which is a completely open database system. WinCC provides ODBC and SQL Server database access to the database for configuration and process control. The configuration and archive data of WinCC are stored in a relational database, and the data can be read out with standard tools such as ODBC and SQL [2].

According to the design requirements of the system and the actual needs of the site, the data that needs to be collected mainly include lifting weight, lifting height, running stroke, door limit, running chain between mechanisms, safety distance, overspeed protection, operating instructions, working hours, motor Status, etc.

### 2.3 Remote upload of local data to the server

The system uses OpenVPN technology to upload data to the cloud server. OpenVPN is VPN open source software that works at the application layer based on the SSL protocol. Its core technology is the virtual network card, and then the implementation of the SSL protocol. OpenVPN uses the Open SSL library for encryption and verification, and all encryption is handled by the Open SSL library to ensure data security and reliability [3].

### 2.4 Java-based remote monitoring platform software design

The system uses Java programming language to develop remote monitoring platform software. The remote monitoring platform software is mainly composed of server data receiving end, server data processing end, database, data interface service, mobile phone short message server, remote

monitoring system server and client to realize the system User login and user management functions, login URL and interface are shown in Figure 2. Design a GUI interface to better present these data to the user client. The interface mainly includes the login interface, the main interface, the operation status interface of each organization, the PLC program monitoring interface, the historical curve query interface, the failure pre-alarm interface, and the equipment maintenance management interface, Production statistics interface, etc. Through big data analysis of the collected data using data fusion processing technology to realize the early warning function of equipment, early warning of equipment that needs to be updated and maintained, and timely reminders of possible dangerous working conditions.

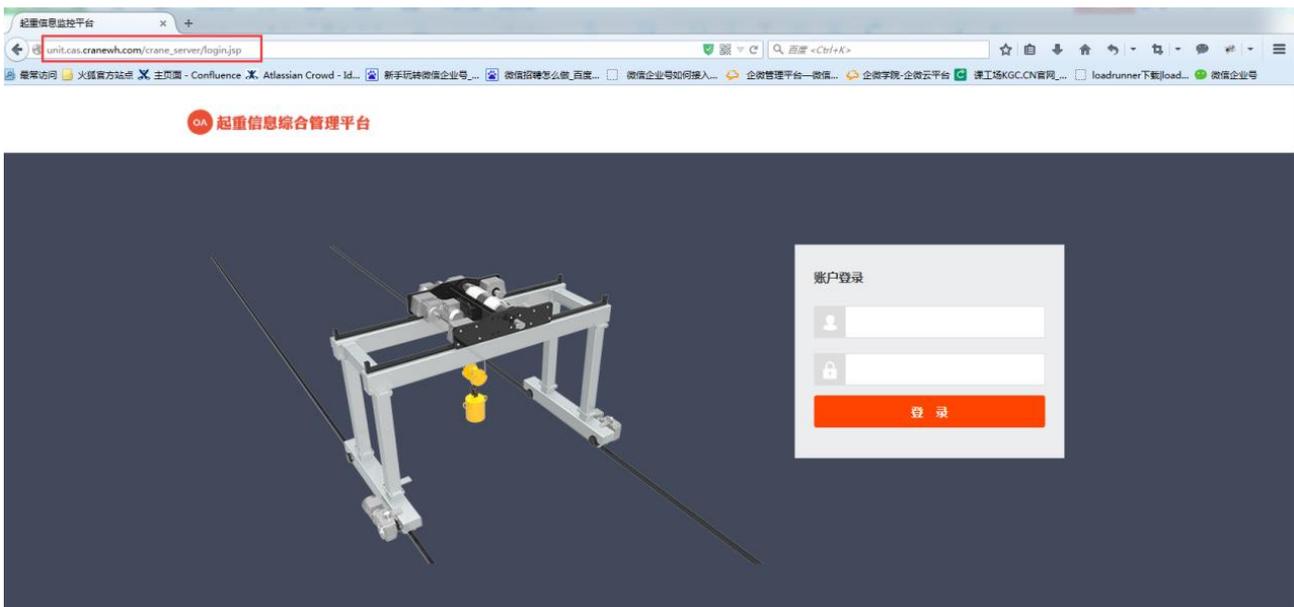


Figure 2. Remote monitoring platform software login interface

### 3. Concluding remarks

The crane remote monitoring and maintenance system based on OpenVPN technology researched and developed uses M874-3 to realize the remote upload and download PLC program function. There is no need to go to the site to debug the program, saving time and road expenses, and it can also carry out the equipment when the customer defaults on the balance. Forced to stop operation. Using OpenVPN technology for data transmission improves the security of data transmission. Using data fusion processing technology to analyze big data, early warning of equipment that needs to be updated and maintained, and timely reminders of possible dangerous working conditions, reducing maintenance costs and the probability of danger.

### References

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