

# STUDY ON INFORMATION MANAGEMENT SYSTEM AND ITS APPLICATION IN COLLIERY ENTERPRISES

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Abstract: Bad working environment and traditional management modes bring lots of hidden dangers in colliery enterprise. Now the enterprises are approaching to modernization and informationization which will deal with lots of data collecting, analysis and processing. In this paper the system architecture for management and under-mine control is proposed. One small enterprise LAN adopting the three-layer module is established, one four-layer data model is designed and one information management system is implemented. This system has gotten practical application in colliery enterprises, operating efficiently and reliably. Moreover it has provided the integrated environment for data collecting and abnormal warning under the mine. Based on the platform, mining coal control and personnel positioning can be further implemented.

## 1 INTRODUCTION

There exist potential security problems in colliery enterprises and the traditional manual management is not efficient. (Zhao Zuopeng, 2010). Lots of problems such as hidden dangers and personnel safety bring new challenges for the development of colliery enterprises. Nowadays personnel positioning system, gas and temperature warning system are necessary in colliery enterprises. (Duan Dongsheng, 2009). Developing information network and improving management manner are a prerequisite. Therefore constructing a safe and efficient information transmission network is the basis. Since the employees in colliery enterprises are of much mobility and of complex backgrounds, the personal information is extremely great and varied. The safety of the transmission network and the effectiveness of the data structure are essential to the enterprises. (Liu Zhuangxu, 2010 and David, R., William, J., 2006). Layered data structure can simplify the data representation. Information management system can improve the effectiveness and reliability.

In this paper the system architecture including video supervising, abnormal warning and information management is proposed for the colliery. An information transmission network is constructed to transmit and exchange data and one enterprise

data management system is developed.

## 2 SYSTEM ARCHITECTURE

As a transmission platform, the network should server for information management and production control. Combined with the management system, video supervising can offer foreground information for employee positioning. Owing to the characteristics of colliery, such as the complex working environment, the mobility of employees and so on, under-mine control is also required. The main framework designed for the colliery enterprises is shown in figure 1.

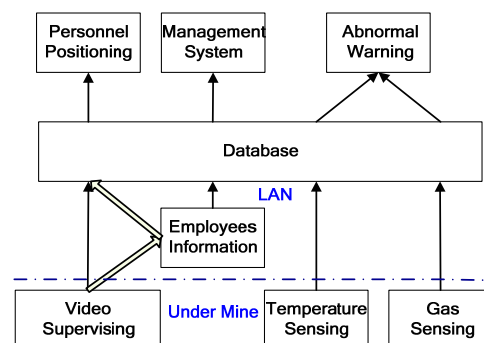


Figure 1: The General Architecture for the Colliery.

The general architecture consists of two parts, the under-mine system and the up-mine system. The links between the two parts are LAN and database. Combined the collecting data transmitted by the sensors with the stored data transmitted by the LAN, this architecture can satisfy the requirement for safety and effectiveness in the colliery.

### 3 SYSTEM IMPLEMENTATION

#### 3.1 Information Transmission Network

In this paper three-layer module (core layer, distribution layer and access layer) was designed to construct the transmission network. (Cai Longhao, 2009 and Wang Yong, 2010). It implemented the high-speed connections between the whole company and the information centre by the 1000 Mbps switch network. The structure of the transmission network is shown as figure 2.

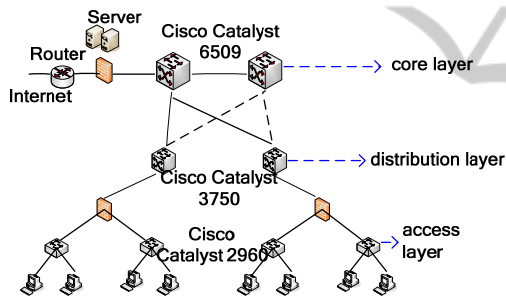


Figure 2: Structure of the Transmission Network.

Cisco Catalyst switch 6509, a third-layer switch, was chosen as the core switch which has routing function and supports VLANs. The dual-machine backup structure was applied in the core layer. The links to the distribution layer switches were set as redundant mode. To guarantee network safety, access control lists were set. The server can access all the internal computers, but no external network. The departments' computers can access those belonging to theirs' and the server, but no different departments' computers.

The reasonable planning of IP address plays an important role in the network design. For IP address assigning, the reserved address of type A, B, and C (10.0.0.0/192.168.0.0 /172.16.0.0) can be referenced. Furthermore reasonable VLANs must be designed for the purposes of under-mine warning. Each

VLAN should have free space for department increasing and mixing.

#### 3.2 Data Structure Model

Relational data model was employed in this paper to establish the data structure. Using SQL Server 2000, data structure of the management system which is shown in figure 3 was designed as four layers.

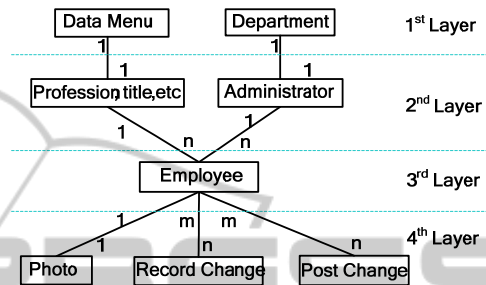


Figure 3: Data Structure Module.

The first layer includes data menu and department. The data menu decides which employees' information exists in the second layer. The department determines management types of the administrators in the second layer. The second layer includes attributions and administrator. The attributions define employees' information. The fourth layer includes photo information which is restricted with the employees' information in the third layer. Using foreign keys, information in the fourth layer must be in the range of the existing staff.

The design of data model focuses on the consistency, integrity and security of data. For consistency and integrity, when deleting and modifying department information, the staff information in this department was deleted and modified as well. For security, different levels were set to manage different ranges of staff and different operating authorities were assigned to implement different uses of every function module. Also the data structure is vivid, concise and easy to update.

#### 3.3 Information Management System

This management system is for small and medium-sized enterprise. Object-oriented language C++ and ODBC were applied to implement the system functions and access database. According to different function modules, the system was divided into separate data management structures. The function of the management system is shown as

figure 4, which includes login module, employees' information management module, post adjusting module, operation recording module, setting module and data processing module.

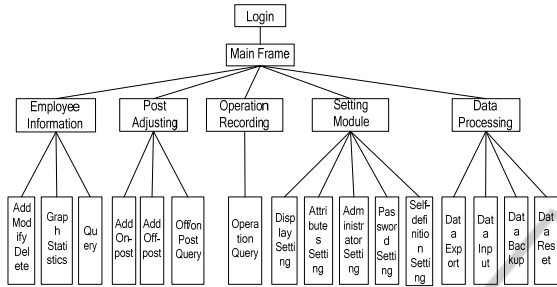


Figure 4: Function of the Management System.

(1) Login Module: Role-based access control is an effective manner for system stability and flexibility, especially for colliery enterprise which has various departments and posts. (Zhao Shufang, 2010). Here the administrating levels and the authorities were designed separately, so were the user names and the employees' names. This design can set different management ranges of every operator and different usages of every module. Compared with the manner used in Zhao Shufang's paper, binary number can implement the function easily and flexibly. Select '1' as having the authority and '0' as not having. 'xor' is applied to implement modify easily.

(2) Employees Information Management Module: For personnel positioning, the employees' information concludes not only text information but also picture information. Accessing between the database and the system was completed by using CDatabase and CRecordset class. (Wang Jingyang, 2003). The difficulties here are saving and display photos by ODBC. The solution is shown as figure 5:

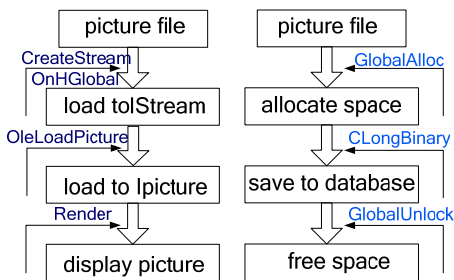


Figure 5: Sketch of Displaying and Saving a Picture.

In this paper pictures can be saved just in the server, thus the data amount is decreased and the

data consistency can be ensured. Using 'IPicture' variable, picture types can be of various, such as 'jpg'. Thus the data amount is decreased further and saving one picture is more flexible. For picture printing, we still need the 'IPicture' class, based on 'LoadPicture' and 'Render' function.

(3) Post Adjusting Module: Since the employees are of much mobility, a specific module should be layout to manage on and off post information.

(4) Operation Recording Module: Administrators' operations are recorded in this module in case of changing information frequently. As the employees' information is related with the personnel positioning system, the falsely changed information will bring unexpected effect.

(5) Setting Module: This module makes the system more flexible and various. Combined with the login module, the administrators' levels and authorities are assigned and modified. Meanwhile according to the administrators' demands, the displaying frame and some attributes can be modified.

(6) Data Processing Module: Inputting and exporting between data information and Excel were implemented, thus the efficiency of the system was enhanced. Moreover for system upgrading, repeated information inputting can be reduced. In some certain extent, the operation efficiency of the colliery enterprises can be improved. Also data backup and resetting were taken into account.

### 3.4 Communication in the System

As described in Section 2, the entire systems are divided into seven systems. The temperature sensing and gas sensing system work for the abnormal warning system to decrease or eliminate incident under the mine. The video supervising system works for the personnel positioning system to guarantee the employees' safety. All the separate systems exchange and restore data by the means of network.

## 4 CONCLUSIONS

The main architecture designed here uses LAN to communicate between under-mine and up-mine. It can achieve the goal of information management and under-mine control for the colliery enterprise. Based on the architecture, one stable three-layer network, one effective management system and the data model were established. Furthermore take the

network as a communication environment, some other purposes such as collecting gas and pressure under the mine can also be constructed besides employee positioning. Not only can it be applied in the colliery enterprises, but also be used in other similar cases.

## ACKNOWLEDGEMENTS

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