Construction and Optimization of the Distributed Network Monitor and Control System

Xinbo Li, Yaowu Shi, Fang Dong

Abstract-- A distributed collection and control system is designed with Internet public ADSL net, GPRS net, IEEE 802.11b wireless net based on the C/S structure. We realize the system. Although it is running stably, it must be optimized due to more client server, complex operation and control level, great data quantities. This dissertation probes into the optimizing problem with web, database and user management.

Index Terms-- Distributed collection and control system, Web Optimaztion, Database Optimaztion, user management Optimaztion

I. INTRODUCTION

With the great development of the technology of network and control, intelligence instruments based on network emerge as the times require[1]. Also, a series of net collection and control systems come to being, and even are brought into use in the field of industry, military, medical treatment, science, education and so on[2,3]. At present, however, these systems are all dependent on certain conditions, so they don’t possess universality, let alone openness.

Based on the monitor system of heat-supplying pipe network, this dissertation makes full considerations into supervisor system’s universality while designing own system. Coupled with Internet public ADSL net, GPRS net and IEEE 802.11 wireless net, it is convenient to build the network, and meanwhile we can select different network under different conditions. Furthermore multi-networks can coexist. Adopting Modbus protocol, OPC(OLE for Process Control) facilitates the system to communicate with the local control units and the old control system. Using the technology of COM(Component Object Model), DCOM(Distributed COM), DDE(Dynamic Data Exchange), some logical sections can be totally separated, such as data displaying, data collection and process, database management etc. Thus the system’s coupling is greatly weakened so that it can be reused, extended and convenient to be upgraded and maintained. Because of more client servers, complex operation and control levels, great data quantities while designing system, this document probes into the optimizing problem with web, database and user management.

II. SYSTEM STRUCTURE

A. Network Structure

In this paper, we probe into a distributed collection and control system based on network. Using the web, this system integrates distributed and independent collection and control units into a industry computer collection and control system which can share resource, co-operate, separated operate, intensively manage and so on.

In this system, there are three kinds of networks. Internet public ADSL net is a sort of universal network mode(demonstrated by fig.5). Resorting to the technology of VPN(Virtual Private Network), we can set computers based on public net IP to LAN(Local Area Network) structure. Thus, through ADSL dial-up, the distributed computers can visit sharing-resource, and form a safe sovereign private network which is characteristic of higher reliability, more flexible and convenient web-forming and smaller investment etc. GPRS (General Packet Radio Service) based on GSM is a kind of wireless packet exchange technology, and it provides end-to-end and WAN (Wide Area Network) wireless IP connection. The communication GPRS based on IP address is a sort of packet data transmission network. Because the deploying center is equipped with the fixed IP address, and every data-monitoring station, with GPRS DTU, transmits the data to the host computer of deploying center by the means of packet, thereby a data transmission platform is built through the wireless public network, which achieves better real-time, remote control, wide covering and lower construction cost etc. In addition, as far as the current techniques are concerned, it is a kind of data transmission means which is suitable to popularize and generalize. In 1997, after seven years’ hardworking, IEEE issued protocol 802.11 which is the first protocol recognized internationally in the field of the wireless LAN. The protocol 802.11 mainly works in the two lowest layers, and makes some modifications in the physical layer----including the property of high-speed data transmission and the stability of connection. This standard technology enable the controller, under some certain
conditions, to select the appropriate LAN techniques to construct own network in order to meet the requirement of their commercial users and other users. In contrast to above two networks, IEEE 802.11b wireless network is suitable to direction-fixed transmit in the area of 10km square, and its transmission speed is higher and the subsequent cost is never needed after the first investment. But, the cost of construction network is higher accordingly. Besides, more maintenance is necessary, because the transmission conditions are affected directly by some factors such as climate, whether and so on.

In view of the above advantages and disadvantages, the heat-supplying monitor system, discussed in this dissertation, adopts multiple communication modes to build the network according to different monitor stations in the different locations and the locale conditions, which can, to the largest extent, improve the flexibility and extension of the system. In addition to the above three communication modes between monitor stations and the deploying center, we can also think of using PDA connected with the monitor stations by IEEE 802.11 protocol, so the patrol near the station can check the state and parameters of station with PDA during the permitted area, and also receive the real-time missions arranged by the deploying center.

B. Monitor End
The monitor end consists of embedded touching screen based on winCE OS, PLC of Siemense S7-200 and some locale transformers, sensors, delays. The specific structure is demonstrated in fig.1.

C. Deploying center
The software of deploying center is based on the technology of multi-protocols amalgamation and component. In the protocol, Modbus, a kind of general language of control units, and OPC standard, a sort of general standard in the field of industrial process control, are adopted. With the protocol and the standard data-visiting mechanism, the software can flexibly get the data and state information of equipments or old control system, thus the capability of the system extension is improved. The system is integrated with the Ethenet techniques, which involves the communication among the multi-computers. The traditional communication method programs directly aiming to the network protocol by the means of socket. It is relatively complicated to develop the applied software. Moreover, it is very hard to upgrade and extend the system and to integrate with other systems. By adopting the COM/DCOM technology, among the different computers, program communication is realized and the code can be reused. By using the DDN technology, the channel between collection system software and other applied software is established, and the sharing-data bridge among the applied programs is built. For example, based on DDE technology, it is realized that the database of collection system is connected with office, Macrosoft software. A typical example is demonstrated in the fig.2.

III. SYSTEM OPTIMIZING

A. Network Optimizing
At present, though the network discussed in this document can integrate the webs with different protocol and different topological structure in order to meet the need of information management, it is often jammed, which constrains the collection system to develop deeper. After the detailed analysis, it is thought that the above problems are resulted in by the irrationality of some factors such as IP address design, VLAN(Virtual LAN) design, network strategy and so on. So a rational network integrative scheme has to been wanted to optimize the efficiency of network system and provide the basis for adjustment that ensures the network to run efficiently.

![Fig.1 monitor system structure](image-url)
b. Make VLAN regulation for network. The old network has no VLAN regulation. But, the VLAN regulation can divide the network into some subnets in order to be convenient to manage the network, and the data are confined within the local area, which makes section or workgroup’s data to flow safely. Besides, the network is isolated with the radio area, thus the property is improved greatly. The communication among the virtual networks can be managed by the means of net subsection with the function of the exchange machine’s third layer, and data transmission among all the net sections can be controlled safely.

c. In the whole network, a corresponding net strategy setting is necessary, because there will be lots of data transmitted into the serve. In the net strategy, adding QOS function, recognizing and assorting the data by multi-layers effectively secure superior transmission of some important data in the system and ensure the data safe.

B. Data Optimizing

Though collection system database actualizes resource-sharing, the sharing also brings the conflicts. When the multiple users' parallel processes renew the same datum at the same time, they will probably affect each other, and destroy the integrity of database. The extension of system’s sub-station will bring the augmentation of database. Thereby, as for the huge database, the speed of visiting and modifying will become slower accordingly. However, running speed and executive efficiency are important criteria of the system database’s property. So, relieving conflicts, improving database visiting speed are the superior problems to solve in this paper.

a. In order to reduce the conflicts, we can think of running the business during the course of storing, not making communication among the users in the business, and avoiding appearing the “heat spot” area. If necessary, we can logical horizontally or vertically divide a big form into some smaller forms, and reduce the lines in every page, and design the index for some important data operating orders.

b. Store some data information used frequently in the buffer, and not visit the disc to search the information. So, operating against the disc I/O is reduced. It is one of the methods to improving database executive speed. Rational allocation of the buffer helps greatly quicken the data-visiting speed and improve the system property.

c. Compile the database process or function with the database describing language, and then pack the process or function, and put them in the behind-platform to run together. By this way, we can make full use of the data behind-platform processing scheme in order to reduce the network flow and improve the database dynamic property.

C. User Management Optimizing

When considering user management optimizing, we should ensure that, as for any user under any condition, the data visited by the user are just ones that the user has right to visit; As for any user under any condition, the data modified by the user are ones that the user has right to modify. This naturally relates to system’s authorization for the operators. The user’s purview considered includes three aspects----function purview、record purview and word-section purview. Altogether, the record purview and word-section purview are also named data purview.

In this system, the record is the smallest unit that can be authorized. As for the data object that can be authorized, every record all has its only mark. When authorizing, every record is all authorized, but it is impossible when there are too many records. At this time, these records probably can be logically divided into groups which are defined as different roles, and then authorize every role. By this way, the complexity of authorization management is reduced greatly.

①. The record grouping defined by the part authorization of the record should take tree-structure, form big class to small class, and then to the leaf which is every record. The sub-layers of data groping can be added at random.

②. The data authorization form is mainly used to define the authorization relationship between the users and data roles.

③. Construct the user’s authorization data viewgraph. Based on all above forms, we can get some user’s authorization data viewgraph.
IV. SUMMARY

This paper realizes the design of monitor system with the system network structure, protocol compatibility and software character, and as for some questions appearing while building the system provides corresponding optimizing methods with web, database, user management. The results prove that these methods are effective and also very necessary for building the monitor-control system.

REFERENCES


Fig. 4 user authorization data viewgraph

Fig. 5 Web Structure