Application of Modern Communication Approaches in Remote Monitoring and Controlling of Automatic Surveying

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Abstract: In this paper the application of two remote monitoring and control methods based on network communication techniques in automatic surveying system engineering is discussed. In the automatic deformation monitoring system for subway structure of the city, modern communication methods are used to implement remote monitoring and controlling over the whole system. Two approaches of remote monitoring and controlling that are built in system will be discussed. One is cable communication based on ADSL, the so-called "net jet car", the other is wireless communication based on the GPRS of mobile phones. With the help of modern communication methods, remote monitoring and controlling in a lot of kinds of surveying programs can be realized. Not only is the maintenance of the whole system facilitated, but the cost of the whole system is reduced. And manual workload is greatly reduced. The remote monitoring and controlling of the system can not only enable technicians to provide maintenance but also make inspection and decision-making more convenient.

1. Introduction

With the rapid development of modern science and technology, there have emerged kinds of electronic, digital, automatic, intelligent and integrated surveying instruments, which enable surveying workers to build a lot of automatic surveying systems conveniently. In addition, with the help of more and more advanced communication approaches, the technique of remote monitoring and controlling can be easily realized, which enables people to monitor and control the whole system without leaving where they are seated. With this technique, technicians and managers can know the real-time operation of the system so as to make decisions fast and effectively and in time if something is wrong with the system. In order to

keep pace with the automatic surveying system engineering, it is necessary to have a study on schemes of remote monitoring and controlling.
In a project of the automatic deformation monitoring system for subway structure of the city, modern communication approaches are utilized to realize the remote monitoring and controlling over the whole system. Here two approaches of remote monitoring and controlling that are built in the system will be discussed. One is cable communication based on ADSL, the so-called "net jet car", the other is wireless communication based on the GPRS of mobile phones.

2. Cable Communication Based on ADSL

2.1. Introduction to ADSL

ADSL is the acronym of Asymmetrical Digital Subscriber Line. It is a technique that supplies Broad Band data transmission service through average telephone lines and has become a new operation platform used to provide Broad Band service for families and small enterprises. ADSL can provide a download rate as high as 8Mbps and a upload rate as high as 2Mbps on existing lines. Compared with the 56Kbps rate of average dialing Modems, ADSL is hundred times faster and supports general Broad Band application services, such as high-speed Internet browsing, telecommuting, tele-meetings, virtual private web and stream format multimedia application. Another advantage of ADSL is that it can coexist with average telephones on one line with data transference and answering phone and dialing at the same time without affecting each other. In addition, it is extremely convenient and fast to install ADSL on existing line because only special communication terminal device need to be installed on user's end and no other change need to be made of existing line.

2.2. Monitoring and Controlling Based on ADSL

In order to have convenient management, a direct dialing telephone with an external line in stationmaster's office is necessary. On this external line ADSL can be installed and thus access to the Internet through the ADSL enables remote monitoring and controlling function in the Automatic Deformation Monitoring and Controlling System without affecting the communication of the subway station. Figure 1 describes the system:

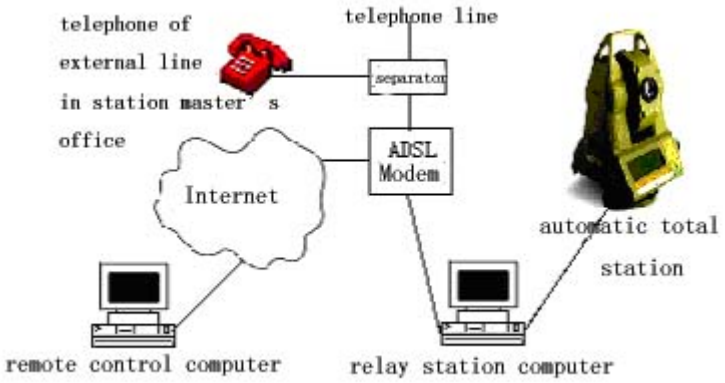

Figure 1: Cable communication based on ADSL

A special separator is installed on the line of direct dialing phone in stationmaster's office on the first floor underground and then two lines are separated out, one line connecting into the phone line to enable the normal use of the phone, the other line connected with the ADSL modem that is connecting with the network card in a computer of the relaying station. The Computer is placed on the platform on the second floor underground in which the automatic deformation monitoring and surveying software ADMS is installed that controls the automatic total station TCA2003, the so-called "surveying robot", to make automatic monitoring and surveying with the real-time result displayed on the screen of the relaying station computer.
The relay station computer is connected to the Internet through ADSL and is assigned a fixed IP address. Because the general engineer of the project must know the system's operation and monitoring result, the computer in his office has also been connected to the Internet through ADSL(or dialing and broad band) and thus becomes the remote monitoring and controlling computer.
Here a software named "remote manager" that is developed by the author is taken as example. The remote monitoring and controlling software "remote manager" is installed on both the relaying station computer and the remote monitoring and controlling computer which are all connected to the Internet. In the relaying station computer, the operator can start "remote manager server" of the software and set up access password to the client computers, then send the IP address and corresponding password of the relaying station computer to the remote controlling computer which is in the general engineer's office.
Then the operator start "remote manager client monitor" of the monitoring software on the remote controlling computer, then input the IP address (for example, 61.168.14.202) of the relay station computer in the "Connect to…" dialogue box, and then choose "total control" as the connection type, finally click the "connect" button. In the following dialogue box named "password" the operator input the access password that has been set up in the relaying station computer and wait a moment (it depends on the connection rate), and then the content that is being displayed on the screen of the relaying station computer appears on the screen of the remote controlling computer as if it were its own screen. And through the mouse of the remote controlling computer he can manipulate the software in the relaying station computer at will without any delay as if he were operating a local computer. Hence in the general engineer's office the whole deformation monitoring system's operation can be monitored and controlled at any time.
In addition, the software "remote manager" can also monitor and control more than one computer. That is, a server(computer under control) can be monitored and controlled by several client computer(controlling computer) and vice versa. Of course, if the password of the server is unknown, no monitoring and controlling can be done, which guarantees security of the system.

3. Wireless Communication Based on GPRS

3.1. Introduction to GPRS

GPRS is the acronym of "General Packet Radio Service" and is a packet radio exchange technique based on GSM(Global System for Mobile Communications). GPRS provides end-

to-end, wide-area and wireless IP connection. Generally speaking, GPRS is a technique of high speed data processing which transfers data to users through packet. It is a wireless communication standard which has a rate of 150Kbps, about 15 times faster than the rate of WAP (Wireless Application Protocol) of GSM that is only 9.6Kbps.

Based on the packet technique, data's transference and receiving is done in packet, so users can access the Internet through GPRS mobile phones at any time and any place without any breaking off, thus realizing "on line forever". What's more, the fee is calculated not in time but in data flux, which reduces the cost of communication to a great extent.
GPRS supports many band widths and thus makes efficient use of finite band width, and it is especially applicable in small quantity of data transference, such as sending and receiving emails and net browsing. Of course it can also be used to transfer data of great quantity. The near future will see faster wireless connecting approaches.

3.2. Monitoring and Controlling Method Based on GPRS

The remote monitoring and controlling method based on GPRS is shown in Figure 2.

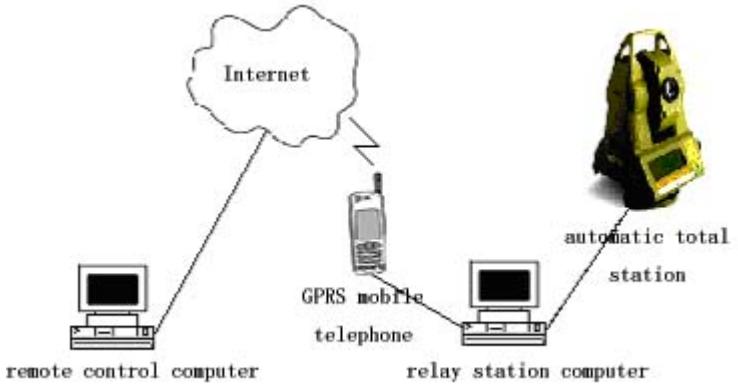

Figure 2: Wireless communication based on GPRS

The type of mobile phone used in this experiment is "Simens 3618". The computer can access the Internet wirelessly through the mobile phone when the mobile phone and the relaying station computer are connected through the special cable with one end connected to the phone and the other end to the serial port of the computer. When there is no connecting cable, infrared ports of the mobile phone and the computer can be used to form connection. However, the connecting distance of this method is a little shorter and the maximum distance is 30cm, and if the two infrared ports are not well located, unstable connection will appear so this method is not recommended here.
Firstly in the relaying station computer a new hardware named "Standard 19200bps Modem" is added, then in the dialing network a new connection is built of which the phone number is set as "*99#" with the connecting method as "Standard 19200bps Modem", and the user name and password are not needed. By this means the relaying station computer can access the Internet through the GPRS mobile phone wirelessly. Then the operator start the "remote manager server" in the relaying station computer. As the mouse pointer is moved onto

connecting icon of the system tray, the IP address of local computer is displayed. In this way, after setting up the access password of the client computer, and then sending the IP address and the password to the remote controlling computer with the same configuration as described in section 2.2, the wireless communication based on GPRS is realized.

The remote monitoring and controlling through GPRS is different from those of ADSL in that no direct dialing phone with external line is needed. In some place where only inside telephones are available, the approach based on GPRS can be taken into account. For this method, one GPRS mobile phone with GPRS digital service started is enough. Currently the GPRS services have been started in most cities of China, which means this approach has great potential.

4. Concluding Remarks

This paper introduces two modern communication approaches which are used for the remote monitoring and controlling operations of the automatic monitoring and controlling system. By these modern means, remote monitoring and controlling in kinds of surveying projects can be realized. Not only is the maintenance of the whole system facilitated, but the cost of the whole system is reduced. And manual workload is saved. The remote monitoring and controlling of the system can not only enable technicians to have maintenance but also make inspection and decision-making convenient.

The remote monitoring and controlling can also be built within the local network of the engineering units. However, at the early stage of the design of the communication net, no other relational system are taken into account, so there are not enough communication ports, and as a result, the remote monitoring and controlling based on interior local network is not realized. So future communication net design should take other system's access to it into account and set aside enough communication ports, which can facilitate construction of the remote monitoring and controlling system.

References:

[1] Li J.P.: Ethernet Network Base Tele-monitoring System, Journal of Zhengzhou University (Engineering Edition), 2002, 23(3).

[2] Bao, H., Xu, Z.Y., Zhang, L.J.: Application of automatic deformation monitoring system in subway structure deformation monitoring, Journal of Surveying and Mapping Institute, 2003, (2).

[3] Zhang, L.J., Xu, Z.Y., Bao, H.: Automatic polar coordinates difference surveying system and its application in deformation monitoring of outer side of dams, Bulletin of Surveying and Mapping, 2001, (9).