WebAccess Based Remote Graphic Surveillance System for Mechatronics

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Abstract

This study employed WebAccess software to construct a remote graphic surveillance system, which was developed differently from previous remote monitoring systems. Advantech WebAccess is a web system structure, thus, it can reduce the time required for building a web server, and the system can be developed online or locally. Remote monitoring can be realized by downloading directly from a remote network or local end. Due to the popularity of the Internet, and its easy accessibility, it is necessary to use a network to integrate a computer communication interface with mechatronics operational data, and display its real time state on a remote computer screen. This system takes a PC, the Internet, and a mechatronics module as a case study. The system includes: (1) the mechatronics module; (2) WebAccess software; (3) a graphic surveillance system, displaying the mechatronics I/O state, register, and human interface design conditions on a monitoring system; and (4) IP-CAM images.

Keywords: *Remote control, graphic surveillance system, mechatronics, WebAccess*

1. Introduction

The widespread usage of Internet increases the need of web-based software applications for diffusing, searching and exchanging information useful to support a large variety of activities [1]. The ubiquity of Internet, connecting anywhere-to-anywhere, favors the re-definition of the internal processes of an industrial automation, so that its physical boundaries are extended. As the computer industry develops and the Internet becomes popular, networks have been incorporated into systems in most companies, factories, schools, and homes; graphic surveillance software has also developed. The usability of the web-based applications is improved with visual iconic components on hospital information interfaces. Better human-computer interfaces can be designed by the participation of the actual system users [2]. Web-based information system is an attempt to practically implement in real world problems. It provides multiple facilities, i.e. maintaining record, analysis of various parameters for research issues and providing online information [3].

Due to progress in science and technology and developments in the Internet, a variety of information is easily available; automation in most industries is becoming networked, using web servers for remote network surveillance. This eliminates or reduces unnecessary human resources. Industrial automation incorporates graphic surveillance systems in addition to mechatronics technology, for more convenient remote surveillance, to enhance industrial automation capabilities, and realize remote control and real time surveillance over the Internet.

The laboratory enables users to operate the experimental facilities and remotely collect the physical data. These data would be returned and displayed on the users' screen through the network connection. These web-based technologies can also be applied to general remote control systems in many research and engineering areas. Increasingly, human interface platforms are being implemented at various educational levels as a form of teaching support. In addition to promoting flexibility in teaching and permitting the incorporation of new educational materials and resources, distance-learning familiarizes students with the computer as a work tool [4]. The laboratory learning modules developed and taught in the manufacturing and robotics courses, such as robotics modules and a typical senior design project

integrating CAD/CAM and robotics were presented [5]. Engineering education requires substantial laboratory work, which can be costly and rapidly become obsolete. Therefore, laboratory experiments have major economic implications for engineering education.

Surveillance systems have developed from monitoring control switchgear to computer based digital surveillance systems; as PC functionality and performance has improved remarkably, computer based surveillance affords a wide range of technical capability, benefiting many computer applications in factory manufacturing processes, leading to automation of functions such as surveillance, recording, and management. In a graphic surveillance system, a monitoring computer governs the controller via a communication interface—sending operational commands to field equipment, while displaying the status of field equipment and operational data in a surveillance window, so that operators have clear picture of field operational status.

In factory automation, manufacturing equipment often used hardware oriented control panels or human-computer interface consoles for production monitoring and control; but because of the inflexibility of hardware, and high building costs, system expansion and system for future needs was difficult. The operational convenience of graphic surveillance systems makes them desirable for such industrial systems.

This study used a mechatronics module as an example to realize Internet remote graphic surveillance, process various databases through Web remote control, and monitor mechatronics state on computer. By utilizing the advantage of availability and wide connection, an Internet-based distance laboratory was constructed, coupled with a graphic surveillance interface and IP CAM, so that users can conduct remote monitoring of mechatronics real-time operations through the Internet.

Application results of this study differ greatly from previous studies [6-7]. The remote graphic surveillance systems in previous studies required additional Web server, which needs complicated maintenance and cannot directly obtain core data. It is because remote monitoring systems are additional Web pages that are transferred through the Web for Internet browsing, while the WebAccess software architecture of this study is based on the Web, thus, human-computer interface programming, data point building, and construction of all required functions can be realized directly on the Web.

WebAccess is powerful graphical monitoring software, capable of designing and constructing multifunctional human interface, data collection, trend alert processing, and reporting systems. The animation operation interface made of its application can be configured with mechatronics and other controllable I/O devices. This software has many built-in engineering graphs and animations for the convenience of users. An automatic control system based on Advantech WebAccess for intelligent buildings and using the renewable energy source solar energy to improve the working efficiency and realize the distributed control and centralized management of buildings was proposed [8].

2. The WebAccess System

The Advantech WebAccess program consists of three parts: (1) the project node—as a centralized database and web server, the project node provides the initial connection between client and SCADA node, and offers the functions of project manager to create an I/O database, alarm, and graph; (2) the SCADA node—a remote PC, which can communicate with automation devices using drivers supported by WebAccess. The SCADA node provides real time functions and data reports; and (3) the client—a plug-in related to the browser. The client is a human interface that provides functions such as a real time data indicator, flash, trend, alarm, and report. The Advantech WebAccess Client communicates with the SCADA node over the Internet with transmission control protocol/ Internet protocol (TCP/IP) [9].

Besides the above functions, as the system architecture is built on the web, there are abundant internal communication interfaces, databases, and connection communications for various types of PLC devices, such as the ModBus TCP/RTU communication protocol, serial port communication, TCP/IP, dynamic data exchange (DDE), network dynamic data exchange (NetDDE), and open database connectivity (ODBC). These functions can be combined with Internet communications, thus, both data transmission and device monitoring can be done easily. After interface environment planning, an internally driven computer RS-232 provides data exchange connection communications with the RS-422 of the PLCs to realize data transfer.

3.Architecture of Remote Surveillance System

Figure 1 shows the system architecture, where the project and SCADA nodes use a computer as a WebAccess Web server; a PLC RS-422 via a computer RS-232 provides communications. In addition, a web based IP-CAM collects real time images of a mechatronics module for remote monitoring, as well as real time display of onsite status.

A client can connect to a WebAccess Web server computer containing a project and SCADA node directly through the Internet, or directly key in the IP address of the SCADA node for remote device monitoring. To maintain the remote monitoring system software, or modify the system, administrators can directly connect to a project node address to conduct backup and system maintenance of online programs without direct onsite maintenance—saving time and cost.

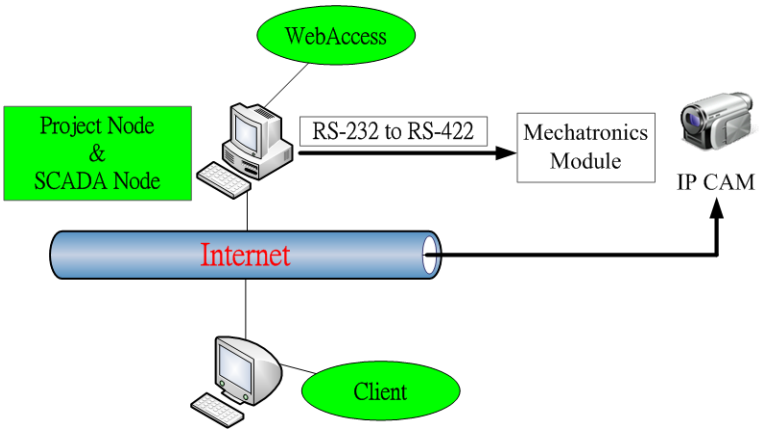

Figure 1. The system architecture

4. Programming of the PLC Contact Point and WebAccess Data Point

Before developing a graphic surveillance system operation interface, the hardware/software data points must be planned, using the security system within the Advantech WebAccess graphical control system to build control privileges of multiple user logins, for efficient control of future remote monitoring management. Table 1 shows the mechatronics module contact point programming. Table 2 shows the Advantech WebAccess data point programming, and Table 3 shows user the login management privilege programming.

The mechatronics module in this study is shown in Fig. 2. From the PC RS-232 to mechatronics RS-422, the signal is fed back to the WebAccess Web server, and a Client can connect via the web to a computer with a project and SCADA node for remote monitoring through WebAccess.

This mechatronics module consists of two main parts: the first part includes the emergency switch X13, which is primarily designed to protect system and for human safety, and the connection point M0, which combines with the graphical control for an emergency stop to provide direct remote emergency protection; the second part is specially designed with an interlock function.

Table 1. The contact point programming for mechatronics module

I/O	Function Description
X0	Material sensor
X1	Photo sensor
X2	Base sensor
X3	Cargo sensor
X4	Left limit sensor
X5	Right limit sensor

X6	Vacuum switch
X13	Emergency stop
Y0	Transmission belt forward
Y1	Transmission belt reverse
Y10	Capture on
Y11	Capture off
Y12	Vacuum on
Y13	Vacuum off

Table 2. The data point programming for Advantech WebAccess

Data Point	Corresponding Point of PLC
M0	M0
X0	X0
X1	X1
X2	X2
X3	X3
X4	X4
X5	X5
X6	X6
X13	X13
Y0	Y0
Y1	Y1
Y10	Y10
Y11	Y11
Y12	Y12
Y13	Y13

Table 3. The user login management privilege programming

Data Point	Description
Admin	Administrator
Guest	Guest

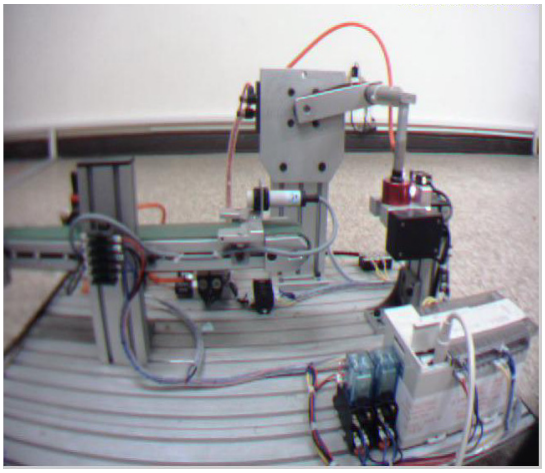

Figure 2. The mechatronics module

5. Graphic Surveillance System

In the remote login page, the user must click Login and input the account and password. If the account and password are correct, the bottom user part will display the current log-on user name to facilitate identity verification. At this point, the user clicks Entrance to enter the motor monitoring and control system. For different users the interface, as well as the user privileges, varies to facilitate system management and maintenance.

Figure 3 shows the monitoring and control page, which contains a control panel on the left. During remote motor control, users can monitor the state of motor actions, system startup, and monitoring system anomalies in time. The WebAccess constructed video display function embeds IP-CAM real time feedback images into the remote monitoring and control system to highlight the actual status and value of remote monitoring.

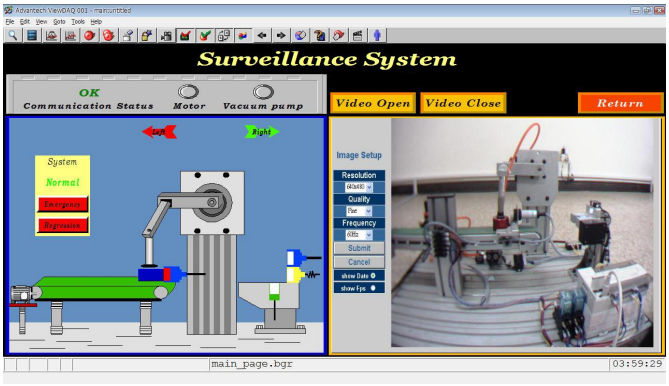

Figure 3. The monitoring and control page

6. WebAccess Project Manager and SCADA Node

Breakthroughs in computer communications technology and the emergence of multimedia techniques are incorporated in the global information network, WWW, have had an immense affect on the entire field of computer applications. Figure 7 shows the project manager for the Advantech WebAccess remote monitoring system, data point, and device connection. A human interface can be developed directly through this manager system, and downloaded via the Web to a remote computer, saving time when building a web server. System administrators can access this page for management and maintenance.

Figure 8 shows the management page of the Advantech WebAccess project node, SCADA device construction, internal data point, reporting, alarm handling, trend graphs and system scheduling, graphical control function construction, download/upload, and system backup. After function design via a human interface and PC end data are remotely downloaded, it connects to a device to create the human operation interfaces. Final online tests can then be performed. If they verify correct performance, the data can be linked to the WebAccess Web server computer via an IP address for remote monitoring and remote system management.

7. System Integration Test

After logging onto a mechatronics surveillance system, the remote user (Client) can utilize the web to monitor the real time status of the PLC module and any devices running in the plant (Fig. 4), or make onsite judgments from remote IP-CAM feedback real time frames (Fig. 5). Thus, device management is more convenient and efficient.

If a user login privilege is set as a guest, then the monitoring and control system privilege setup is only browsing, and control panel operation and management are disabled. Only the system administrator can log into the project management page, which is an advantage of WebAccess system

security management.

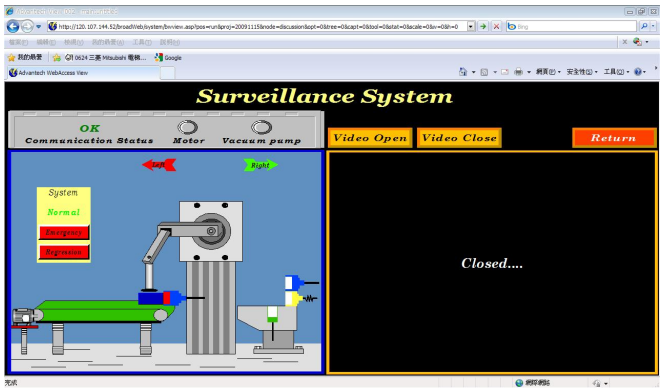

Figure 4. The Web page for monitoring real-time status of mechatronics module

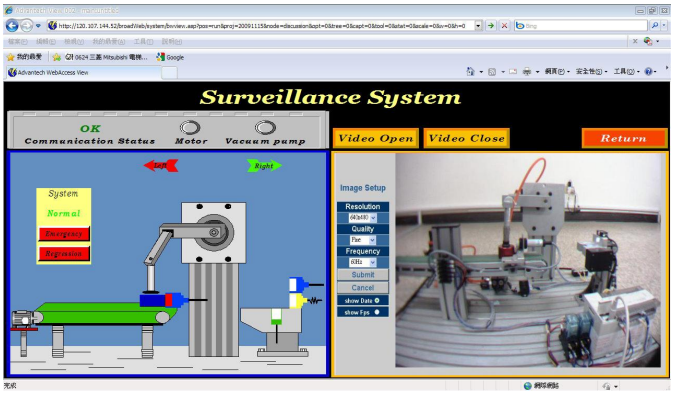

Figure 5. The IP-CAM feedback real time frame

8. Conclusions

The purpose of this study is to develop a remote graphic surveillance system using a mechatronics module. It used the Advantech WebAccess graphical control software to conduct human interface and function programming. The results of this study differ greatly from previous studies, as previous remote graphical monitoring systems required additional web servers to build, are difficult to maintain, and cannot acquire core data directly, because remote monitoring system web pages are transferred from the web for Internet browsing. The WebAccess architecture in this study is based on the web, thus human-computer interface programming, data point construction, and establishment of all required functions can be realized directly on the Web, or without Web online programming. Interface programming can be performed locally, using remote SCADA monitoring of node downloads to complete all tasks. Moreover, it offers convenient remote maintenance; users with administrator identity can log onto a management page directly via an IP address, and conduct various function modifications, backup, and update all data. Furthermore, the remote graphic surveillance system in this study utilizes the advantages of the Internet, which allows users to monitor device operation remotely at any time, transmits IP-CAM images via a local network to a user computer, and provides real time images of onsite equipment operation.

9. References

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