(JZS) Journal of Zankoy Sulaimani, December2008, 11(1) Part A (67-80)
گۆڤاری زانكۆی سلێمانی ،كانونی یەكەمی 2008، بەرگ11(1) بەشی A لاپەرە (67-80)

Secure Client- Server Based Remote Process Control.

***Mohamed Abdullah Hussain,** Univeristy of Sulaimani, College of Science, Computer Dept. Kurdistan Region/Iraq.
Mumtaz Mohamed Ali El-Mukhtar, University of El Nahhrin, College of Engineering, Iraq.
Wrya Mohamed Ali, Research and Development Engineer at Comm.S.A / France.

Abstract

Internet based process control has been in the focus in the past years due to the wide horizons it opens to the industry field, office and home automation. Simplicity (in hardware, software and the required resources) in any system is an asset to have. Especially, in our region in which we lack hardware and software company dealers and a lot of automation resources. It is best to depend on free software as far as is possible in addition to on simple easy repairable systems. In this research a hardware interface circuit and a software system has been designed to control the temperature and level of a liquid tank (water has been considered in our case study). The main advantage of the designed interface circuit is its simplicity and low cost. The same can be true for the software system in which we used Java servlet to accomplish the communication task. Java servlets have many advantages over the Common Gateway Interface (CGI) based methods used previously that has common problems of speed and data persistence. In security aspects a password has been added to all control action commands to secure our process control tasks. In addition to the security introduced by using Dynamic Domain Naming System (DYNDNS) servers that allows the use of dynamic Internet Protocols (IP) for accessing information on the Internet. The designed hardware and software systems could be used for remote or local control with no amendment and for both manual and automatic control. The system could be used with no need to have a public IP for both client and server.

Keywords: Network based instruments control, Remote process, Internet based process control.

1. Introduction

Instrumentation and process control can be traced back many millennia. Some of the early examples are the process of making fire and instruments using the sun and stars, such as Stonehenge [1]. The evolution of instrumentation and process control has undergone several industrial revolutions leading to the complexities of modern day microprocessor-controlled processing.

1.1 Personal Computer Based Remote Control

With the increased role of PC based control and the widespread use of networking systems and the Internet. The idea of interchanging control data among the computers emerged. In many process control systems we can have several PCs controlling several process variables and data could be exchanged between these computers and a supervisor computer or a server. The server may have the role of controlling the PCs and work as process manager. This scheme usually called distributed control.

The server computer that could be on the same site or different site (remote) can remotely control and gather process data

***E-mail:blndo2001@yahoo.com**

**** Cited from his Ph.D. Thesis***

from the stand alone process control PC's (the clients).

Remote control of installation and systems has been a technical reality in the automated industries for many years, particularly in process control industries.

One of the most common used applications for remote control systems involves client-server architectures. The general structure of a client-server based remotely controlled laboratory is shown in (figure 1).

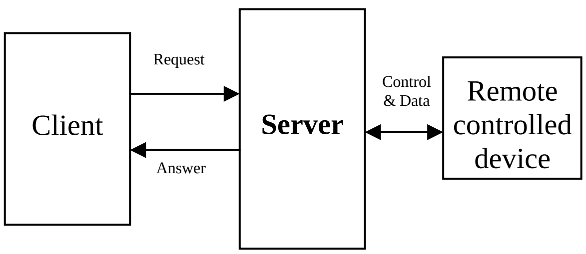

Figure 1 General structure of a remotely controlled device using client-server

Information exchange between process plants and the Internet based clients allows the clients to remotely monitor and adjust the behavior of the process.

1.2 Remote Control Systems Survey

Most of the work in the area of remote control is performed in the field of laboratories and instrumentation control, below is a brief survey on what has been achieved in this field:

A system was developed in which students could perform experiments by remote control via the Internet. At the client site, all that required is a version of the Netscape browser that can accept JavaScript. At the server there is an Hypertext Transfer Protocol (HTTP) server. CGI is used to extract information from the client sent data.

The server controls the experiment itself over a local network, such as over the parallel measurement bus IEEE 488 / IEC 625 and a serial point-to-point connection over RS232 to the laboratories machines and instruments. Using the graphical programming language G and the Internet toolkit from LabVIEW, the engineer is able to design particular measurement and control program. The main experiment is to get ultrasonic measurement from industrial ultrasonic equipment USD15D and two cameras [2].

The work in [3] developed a systematic design method for the design of remote monitoring and control over the Internet. Five essential design issues that arise from Web-related features of Internet-based remote control have been investigated: communication latency, network communication architecture, optimal control structure, web-based user interface, and security aspects.

Swany and et al [4], made an illustration for remote control of hardware in the laboratories for educational purposes. The goal is to eliminate extensive programming using high level languages, such as Java to achieve remote connectivity, and focus in the primary task of implementing control algorithms. The use of MS NetMeeting for Internet-based control is described. Control experiments were carried out by a remote user using Matlab-based real-time tools and MS NetMeeting.

The article in [5] describes a new way of teaching adopted at UNED that uses dynamic and interactive simulations in a stand-alone or web-based environment.

The article focuses on how this new stand-alone experimentation environment maintains a clear separation between the graphical experimentation interface, developed in Java, and the math and simulation engine. By constructing the environment in this fashion, the engine can be replaced with a different one or with a real plant, or can even be ported to a remote server.

A virtual Lab for controlling real experiments is presented. The aim is to provide students access to various experiments in control engineering. The Virtual Lab is based on a distance education concept due to the fact that certain students may be interested in studying even at places which are far away from campus eliminating the necessity to be there in person. In the virtual Lab they are able to gain some practice in control theory at their convenience thereby saving travel time and cost. An approach based on a client/server architecture written in Java is proposed. CGI is used to extract parameters from commands send by the client to the server [6].

Fuller, describes the different methods could be used to achieve remote control. There is a mentioning of Web browsers to achieve instruments control. The use of HTTP protocol has been mentioned to exchange the information between the client and server, but on the server side they were using common gate interface (CGI) to extract information from the HTTP. The work mention some drawbacks of distributing control via the Web that ranges from: High amounts of traffic on the network that could lead to slow update or data transfers. Security is often a concern of Internet-related activities. If the remote system is on the same network as hundreds or millions of other users, the potential exists for possible system interferences. Test and control applications should be implemented so that the network is protected by existing information technology (IT) security systems.

The common CGI drawbacks ranging from speed problem to data persistence and development is shown in [8].

The architecture of a synchronous remote accessing control laboratory is presented. Various communication protocols were tested to access the virtual laboratory on the Web. Tests performed from point to point were very positive. However, the time delay decreased interaction between the process and the user. The paper presents real manipulation of real devices used in an instrumentation and control laboratories on the Internet. Control variable could be level, flow or pressure. A Programmable Logic Controller (PLC) communicates directly with the sensors to receive signals and to activate the actuators. Communication between the PLC and the computer is assured by LabVIEW (a National Instruments graphical software). The user interface is also designed using LabVIEW. A client-server application is set up for accessing through the Internet network in order to control process variables. The server contains the application that communicates with the actual physical system [9].

Cabello and et al, shows that Internet World Wide Web provides a best way to materialize remote access, reducing the requirements in the educational laboratories to workstations (WS) or personal computers (PC) with the habitual Internet access. It is made possible by the use of virtual instrumentation, not in the sense of a simulation tool, but as the remote access to facilities located in related research laboratories. In the work most of the measurement instruments used in test and characterization processes can be remotely programmed from an external controller by using a communication interface IEEE-488. The GPIB (General Purpose Interface Bus) cards is available for any kind of computer, including programming libraries for its control from application written in high level languages. The number of instruments connected to the same controller, and so accessible from it, is only limited by the capacity of the chosen interface (a maximum of 30 instruments). In the work GBIP has been used with HP 9145B semiconductor parameter analyzer implemented in their laboratories. The virtual instrument (HP 9145B) could be managed by the user from any web browser [10].

Page and et al developed, built and tested http-based client-server systems and gateway systems for the remote control of experiments using LabView. One example involves a complex experiment using ultrasonic, eddy-current and optical sensors [11].

Double client-server architecture for an online experiment is presented. The first client-server is between the client browser and the web server associated with the online lab management system. The user connects to the online laboratory using a web browser. The web server is used to render the GUI interface on the web browser. The second client-server is between the online lab management system and the scattered resources that are wrapped as Web Services [12].

The work in [13] presents the objective, strategy and implementation details of a new undergraduate course, Internet-based Instrumentation and Control. It is offered to senior-level undergraduate engineering students who are interested in sensing, instrumentation, control and web programming and wants to learn more about the integration of these technologies for solving real-world engineering problems. In the experiment the student will get familiar with programming environment. In the later stage of this experiment, students are required to use all kind of control statements to form complicated conditions. The basic structure used in this work is to use a web browser by the client. The server is an ASP.Net based communicates with the client. The ASP.Net server communicates through a serial link with a Basic Stamp 1 controller. The Basic Stamp1 controller is communicating with a basic Stamp 2 controller through a wireless link. Basic stamp 2 is a single board microcontroller that runs the Parallax PBasic language interpreter.

In most of the systems which are mentioned, we can see the use of RS-232, RS 485 and IEEE-488 and HP-GBIB hardware [10, 12, 14] for controlling the Lab or the instruments. We did not come across any use of regular computer Parallel Printer Port (PPP) for Internet based remote control. Using the PPP will reduce the hardware cost and increase portability. Some documents mention that there is some timing problem related to the PPP, as written in [14], but for our case the process that has been selected is a slow one and this timing problem and if it may emerge with a high speed process, it will not with our selected one (since there is no high time constraints as it will be explained later in this paper). In our research an actual real process has been created and controlled, a slow process has been selected to minimize the chance of instability.

Also, in the literature we did not come across of using Java servlet to extract HTTP request parameters for process control. In fact the use of CGI has been mentioned.

1.3 Aim of the Research

One of the aims of this work is to explorer and fined new novel ways in the field of computer remote control, suitable for our environment in Iraq. The term "our environment in Iraq" means the consideration of what kind of processes or instruments are available in Iraq suitable for digital control or remote control. What processes could easily be updated to allow remote control.

Methods, techniques and programs that facilitate remote instrumentation and process control were explored. Selection was made on what is suitable and appropriate for our region, which is an important factor for any successful system implementation.

2. The Proposed Design

In this work the following systems and programs (subsections 2.1 to 2.4) have been designed.

2.1 The Water Tank Process

When we have started the project we were seeking for an appropriate instrument or process to start our remote control operations with it. Due to unavailability of an appropriate instrument we have designed a water tanking system and as shown in figure 2. Our major goal has been achieved with it, which are monitoring (by sensing several parameters) and control (through generating several control signals).

It is basically consisting of two tanks, the main one and a sub tank. The main tank has a supply and drain for water flow in and out, respectively. There is a heater inside it, a temperature sensor and two level sensors. The sub tank which works as a reservoir has also a supply and drain lines. The sub tank is much bigger than the main tank to hold all the fluid of the main tank without overflowing.

In the work we have used water but, any other fluid could be used and in that case the level sensors have to be changed. Appropriate sensors capable of sensing the fluid level should be used. With water inside the tank we have used impedance based types, when there is water between the sensors points the impedance will be low and this will generate a logic one signal. When there is no water the impedance will be high and this will generate logic zero signal.

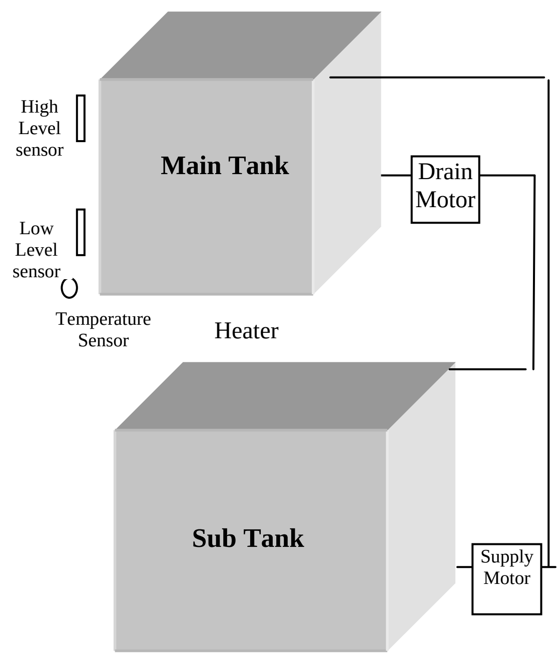

Figure 2: The Water Tank Process

2.2 The Hardware Interface Circuit

As mentioned previously the hardware interface circuit has been designed to work with the Parallel Printer Port (PPP). The parallel port, as implemented on the PC, consists of a connector with 17 signal lines and 8 ground lines. The signal lines are divided into Control (4 lines) , Status (5 lines) and Data (8 lines) . As originally designed, the Control lines are used as interface control and handshaking signals from the PC to the printer. The Status lines are used for handshake signals and as status indicators for such things as paper empty, busy indication and interface or peripheral errors. The data lines are used to provide data from the PC to the printer, in that direction only. Later implementations of the parallel port allowed for data to be driven from the peripheral to the PC.

Three output pins D1 to D3 are used to drive the heater, supply and drain motors. Ack˜, Busy, Paper Empty, Select and Error˜ of PPP have been used to input parameters to the computer. Busy, Paper Empty, and Select are used to read the tank temperature through a simultaneous type A/D converter. The other two pins are used to read the level of the water tank. The hardware block diagram is shown in (figure 3).

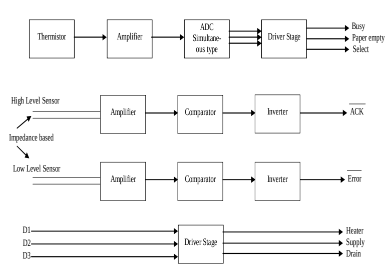

Figure 3 A block diagram of the hardware circuit used to interface the tank to the PC

The hardware has been designed mainly using comparators and TTL ICs. Using the PPP gave the chance to engage the hardware with any available PC with no need to install any special hardware inside the PC. It could be plugged even to most available Laptops. So, the hardware could be packaged in a module that could be mobile. Whenever the operator or user wants to make control tasks all he has to do is to plug in the module to the Laptop or a PC which in turn will work as the server by running tomcat Apache server on it. At the client side, sensors and control parameters could be read and given respectively to the process (plant under control), through and ordinary web page designed for that purpose.

2.3 The Hardware Interfacing Program

A C based interfacing program have designed to work with the PPP. The program consists of codes that read the PPP status port and write data to the PPP data port. In the reading process a filtration process have been introduced to tackle some unstable states we did encounter in the testing phase. The filtered status port data are stored in a binary file with name INPUT.

In writing to the output data port the content of a binary output file with name OUTPUT is sent to the port. A sample of the C program debug screen window is shown in (figure 4) and the program flowchart is shown in (figure 5).

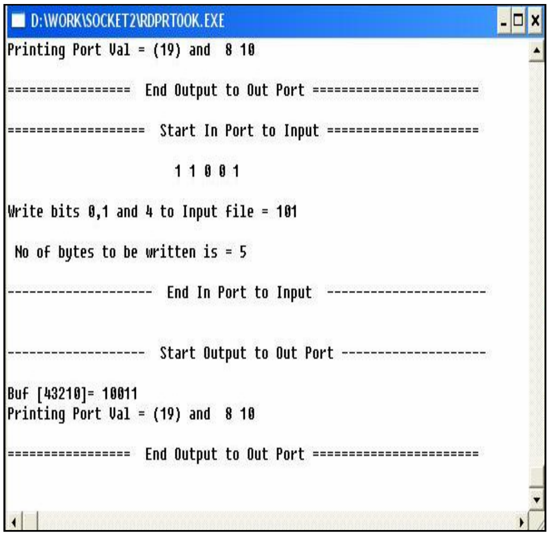

Figure 4: In Port Reading Debug Window

As it is shown in the flowchart the program first get the input port status and save it in variable In, but it will not save it to INPUT file. It will do more input port readings before deciding to save the input in the INPUT file. Two more readings are required and if the other two reading matches the first one it will save the input to the INPUT file.

By this way we will eliminate the chance of storing transient non stable input in the INPUT file. It is true that this filtration will increase the delay of getting the input port status but it will enhance accuracy of the reading. Just like any other hardware filtration it will do an averaging for the input signal.

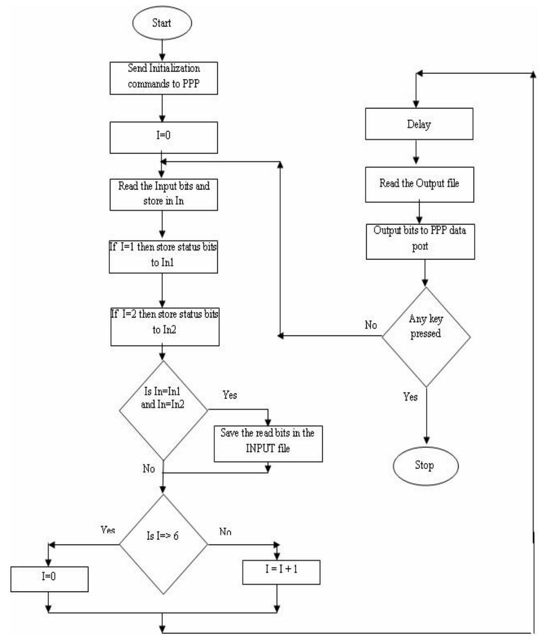

Figure 5 Flowchart of the Hardware Interfacing Program with Filtration

If the next two consecutive reading matches the first one the program will assume that those readings are stable and use them for four more times in the comparison process. Of course the amount of time to depend on the first three readings can be adjusted by varying the conditional statement "Is I>=6". Choosing lower values will decrease this dependability. This value of 6 has been chosen based on practical observation of the input port readings

2.4 Process Analysis and Classification

The systems state transition diagram is shown in (figure 6). The diagram shows the three actuators available in the process and the different states that it could be in.

The process dataflow diagram is shown in (figures 7) and gives view of how data flows inside the water tank process from the Client to the Server.

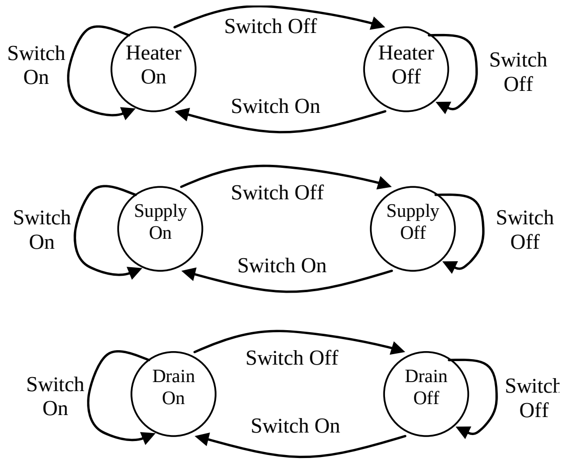

Figure 6 Process State Transition Diagram

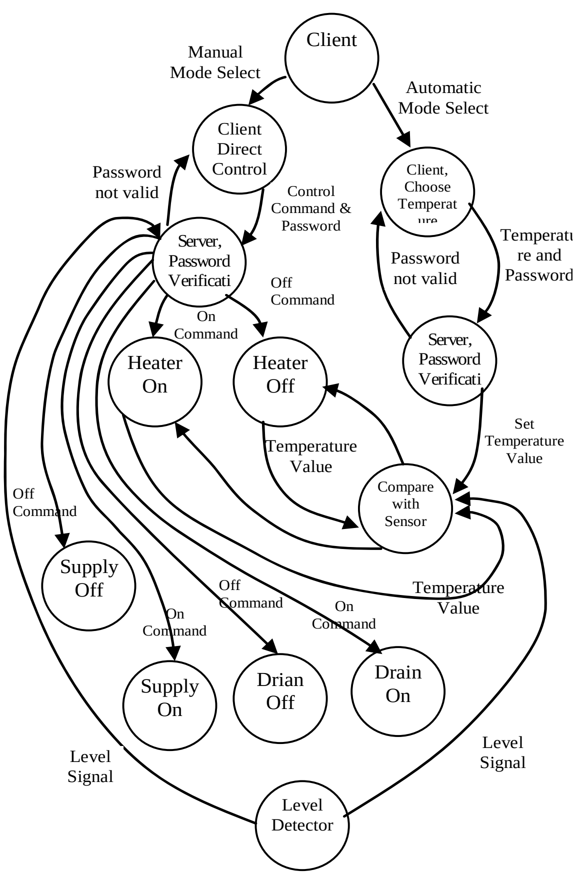

Figure 7 Tank Process Control Data Flow Diagram

The selected process could be classified as a slow process with a non critical time constraint. This gives the opportunities to use it successfully with low speed Internet systems. The system could be used successfully with bandwidth of as low as 4 Kbps.

3. Implementation of the Discussion

3.1 Implementation of the Proposed Design

In the project Java servlets have been used to design the communication programs. In the Java world, servlets were designed to solve the problems of CGI and create robust server-side environments for Web developers. Similar to CGI, Servlets allow a request to be processed by a program and let the same program produce a dynamic response. Servlets additionally defined an efficient life cycle that included the possibility of using a single process for managing all requests. This eliminated the multi-process overhead of CGI and allowed for the main process to share resources between multiple servlets and multiple requests.

In the work two kinds of servlets programs have been designed. One is for manual control and the second is for automatic control. Both kind of servlets are activated by a submit form from the client side. Two main forms have been designed one for manual control mode (figure 8) and the other for automatic control mode (figures 9).

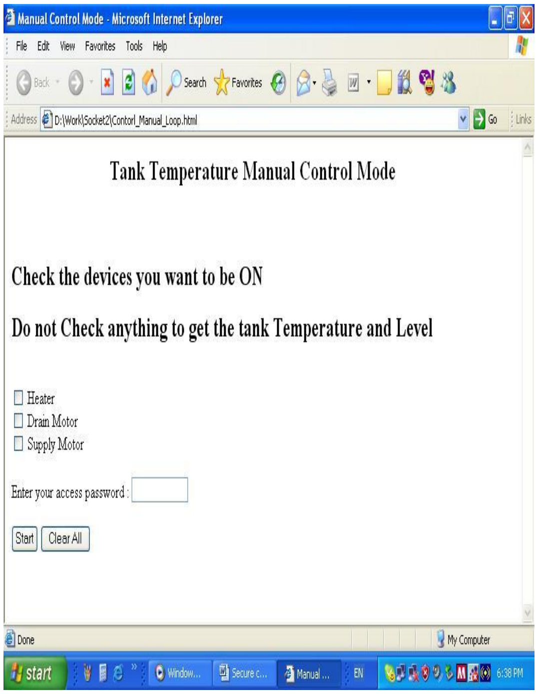

Figure 8: Manual Control Mode Form

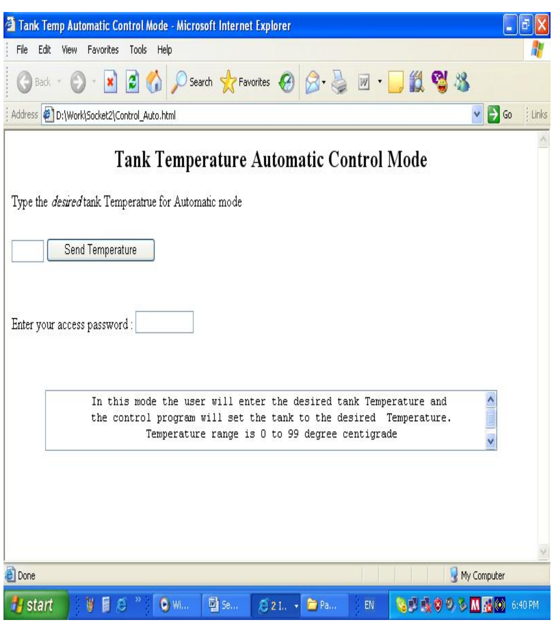

Figure 9: Automatic Mode Submit Form

When the main HTML page is appearing (which is a simple selection HTML page), the client has two options that he can select, one for manual mode (figure 8) and the other for automatic mode (figures 9).

In the Manual control mode the Servlets program will send the control parameters to the OUTPUT binary files and reads parameters from the INPUT file. Then it will encapsulate the input parameters (the current temperature and level) as HTTP response and send it back to the client. The client can send control commands at any time and he will get status back as soon as the servlet program reads the parameter from the INPUT file. It is required that user is aware of the password that the system administrator at the server side should give. Otherwise he can not do any control action. The pseudo code of the manual mode program is given in (figure 10).

Server side programs

Manual Mode with security

```
{
Extract the control parameters from the HTTP Post request;
Extract the password from the HTTP Post request;
Retrieve the password from pass.txt file;
If the retrieved password equals the user given password
  {
    Get sensor temperature and level from the input file;
    Process Level parameter;
    If heater check box is checked then switch on the Heater;
    If supply check box is checked then switch on the Supply motor;
    If drain check box is checked then switch on the Drain motor;
    Send heater, supply and drain commands to the Output file;
    Send response to the server containing temperature and level values;
    Else
 Notify the user that he is authorized to access the server;
```

Figure 10: Manual Mode Servlet Pseudo Code with Security

In the Automatic mode the client writes the desired temperature and the access password. Then the Servlets automatic mode program will go in a loop polling the hardware till the hardware reaches the desired temperature. During this process the client will get continuously the level and the temperature of the tank. The program pseudo code is shown in (figure 11).

Server side programs

Temperature Control, Automatic Mode

```
{
Extract parameters from the HTTP Post request;
Extract the password from the HTTP Post request;
Retrieve the password from pass.txt file;
If the retrieved password equals the user given password
  {
   Store the requested temperature in variable setTemp0;
   Transform the set point temperature to the nearest in band one and store it in
                                                                        setTemp;
   Initialize variable count to one:
   Initialize variable lcount to one:
   Do While (Count is less than 10000  or   lcount<>3)
    {
      Send Temperature and Level commands to the Output Binary File
(OUTPUT);
      Get temperature and level from the Input file (INPUT) and store in
sensTemp1;
      IF  (setTemp-sensTemp)>5   Then   {
                                   If lcount<>1 then send Switch on the Heater
to
                                          OUTPUT;
                                  Send response to the client to signal the
current
                                          temperature and level;
                                  lcount=1;
                                }
      IF  (setTemp-sensTemp)<5   Then   {
                                   If lcount<>2 then send Switch off the Heater
to
                                          OUTPUT;
                                  Send response to the client to signal the
current
                                          temperature and level;
                                  lcount=2;
                                }
      IF absolute of (setTemp-sensTemp)<=5)
                                  Then   {
                                   If lcount<>2 then send Switch off the Heater
to
                                          OUTPUT;
                                  Send response to the client to signal the
current
                                       temperature and level (set point is
reached);
                                  lcount=3;
                                }
      Increase count, lcount;
    }
} Else
       {
           Notify the user that he is authorized to access the server;
```

Figure 11 : Automatic Mode Servlet Pseudo Code

As shown in (figures 8 and 9), the forms for the manual control and automatic control contain a password that the user should supply to initiate a control task. In addition, to use the system on Internet with no public IP, special software tools are required. DYNDNS servers and software have been used in this work. This allows the use of dynamic IP for accessing the servers and clients on the Internet. With DYDDNS the user can create up to five hosts and establish communicate between the hosts. For enabling any of the created hosts the user has to supply a user name and a password.

Any user that is not aware of the password and the user name is not allowed to install the hosts for making communication. By this a dual security mechanism have been created, the first is by using the password embedded in the forms and the second by using DYNDNS

The proposed system has been tested on Internet in both manual and automatic mode. Two ISPs were used: one for the server and the next for the client. The reason for using two providers is to prevent the chance of IP packet forwarding available in modern switches and routers. Command response times were always less than two second which is very acceptable for our process control tasks.

3.2 Discussion

The used Client-Server architecture consumes a very small bandwidth due to its use of HTTP protocol. Usually socket based communication consumes more bandwidth due to its needs for establishing a channel between the two ends which is not in HTTP based schemes.

The process is a slow one; the tank requires about 80 minutes reaching 100°C from 0°C (based on practical calibration). For 10% of tolerance we can have ten degrees of allowance (10% of 100). Taking half of that, to get the allowance in one direction, we get 5 degrees.

So:

5 (allowance) x 80 (Maximum time) / 100 (Maximum range) is equal to 4 minutes.

Hence, within 4 minutes and after losing communication the system will be in the tolerance band. By this simple analysis it could be figured out that the system can tolerate connection failure of up to 4 minutes, if the allowable tolerance is 10%.

4. Conclusion, Features and Suggestions

4.1 Conclusions

In this work a novel approach was used to implement Internet based remote process control. The characteristics of the designed system are:

- Effective, have low cost and simple.
- Could be used for direct (local), network, and Internet based process control.
- Could be used for teaching purposes.
- Modular, the components engaged together could be replaced without affecting other components. For example, in some modern laptops we can not see the PPP port, in those cases a hardware circuit using the USB or a Data Acquisition Card could be used without affecting other parts operation.

4.2 Features and Suggestions

The proposed design could be applied to mobile system if they have Internet or network access.

A client who sits in a mobile vehicle equipped with network access can control the temperature or level of any of the above mentioned processes.

Also, a mobile process like a water tank or a patrol tank can be controlled or monitored from fixed or a mobile client.

The proposed hardware is simple and could be plugged to any PC or Laptop which has a PPP port. This eliminates opening the PC for installing a card, driver installation and compatibility problems, and also allows easy system troubleshooting in case of PC or interfacing hardware malfunction. A market survey made on 19/4/2007 for checking the availability of PPP on modern PC's motherboards (MB) gave us that it is still embedded in modern MBs. Two types have been checked, Gigabyte Intel 865 chipset and ASrock P4I65G, both types were equipped with PPP.

The C language hardware interfacing software and Java based communication programs can be obtained for free from Borland and Sun Microsystems. This will reduce the total system cost.

There is no need to have a dedicated client PC, any available PC could be used the client. The same could be said for the server side PC. In the work we have used a Celeron based 2.1Ghz computer to control the tank in addition to running to our regularly needed programs on that computer, e.g. MS-Office, MSN messenger, Yahoo messenger and Skype. There was no need for a dedicated server.

In addition to the basic use of the system for remote process control and monitoring, it could be used for local or direct control. No changes are required; it is effective for direct control as it is for remote control.

The system could be used at Electrical, Computer, Control and Automation engineering department as an educational system for:

- Use of computers to control devices and instruments (direct).
- Remote control of devices and instruments.
- Write programs to do different control actions.
- Understand the role of process characteristics on the design of control systems.

The processes that this work could be applied to (close in characteristic to our worked on process):

- City water supply tanks.
- Boilers of buildings climate control systems.
- Patrol station's tank level control, after changing the sensors to a proper type.
- Water Dam level control.
- Automated houses water tanking systems.

References

1- William C. Dunn; "Fundamental of Industrial Instrumentation and process Control"; McGraw-Hill; **2005,** ISBN 0-07-146693-2; 1-13.

2- Page,G.F.,Ewald, H.; "Performing Experiments by Remote Control using the Internet"; *Global J. of Engineering Education;* **2000**, 4(3),286-292.

3- Hong-Yan Li; "Web-based remote monitoring and control for process plants"; *Proceeding of the Fourth Internatioal Conference on Machine Learning and Cybernetics;* **2005**, 936-941.

4- Nitin Swany, Ogenjen Kuljaca and Frank L.Lewis; "Internet-Based Educational Control systems Lab Using NetMeeting"*; IEEE Transaction on Education;* **2002**, 45(2), 145-151.

5- J.Sanchez, F.Morilla and S.Dormido, J.Aranda, and P.Ruiperez; "Virtual and Remote Control Labs using Java: A Qualitative Approach"; *IEEE Control systems Magazine;* **2002**, 8-20.

6- Christof Rohrg and Andreas Jochheim; "The Virtual Lab for Controlling Real Experiments via Internet*"; Proceedings of the 1999 IEEE;* **1999**,279-284.

7- Kris Fuller; "Control at a distance"; *Spie's oemagazine;* **2002**, 20-23.

8- Larne Pekowsky, "Java Server Pages", Addison-Wesley; **2004,** ISBN 0-321-15079; 7-15.

9- Maarouf Saad, Hamadou Saliah-Hassane; "A Synchronous Remote Accessing Control Laboratory On the Internet"; *ICEE;* Oslo **2001**, 8DI-30-8DI33.

10- R.Cabello, M.Dieguez, and I.Gonzalez; "Remote Control of Electronic Equipment An Application to the Practical formation of University Students"; *1st Technical Workshop of the Computer Engineering Departament- Universidad Aut noma of Madrid, Cantoblanco-Campus (Madrid, Spain);* **2000**, 1-8.

11- Page,G.F.,Ewald, H.; "Client-Server and Gateway Systems for Remote Control in Engineering Education"; *Global J. of Engineering Education*; **2003**, 7(2), 201-208.

12- Yuhong Yan, Yong Liang and Xinge Du; " Controlling Remote Instruments Using Web Services for Online Experiment Systems"; *Proceedings of the IEEE International Conference on Web Services (ICWS'05)*; **2005**, 0-7695-2409-5/05.
13- Hanqi Zhuang, and Sal Morgera; "An Undergraduate Course-Internet-based Instrumentation and Control"; *34th ASEE/IEEE Frontiers in Education Conference*; **2004**, Savannah, TIH-12-TIH-17.
14- Zafir Hassan, Ala Hasan; "PC Interfacing Black Book";; Spot for Education and Science, **2003**, 585-586.
15- Gregory K. McMillan and Douglas M. Considine; "Process/Industrial Instruments and Controls handbook"; McGRAW-HILL, **1999;** ISBN 0-07-012582-1; 225-232.

بەکارهێنانی ڕێگای کلاینت- سێرڤەر بۆ کۆنترۆل کردنی پرۆسەی پیشەسازی لە دوورەوە.

محمد عبدالله حســین ، کۆلێجی زانســت ، بەشی کومپیوتر، زانکۆی سلێمانی، هەرێمی کوردستان / عێراق

ممتاز محمد علی المختار ، کولێجی ئەندازیاری زانیاری، بەشی ئەندازیاری زانیاری کومپیوتر، زانکۆی النهرین

وریا محمد علی، بەشی توێژینەوە و گەشە پێدان لە کومپانیایی Communications S.A **/ فرنسا**.

پوختە

بەکار هێنانی ئینتەرنیت بۆ کونترول کردنی ئامێر و تاقیگەو لەگەڵ پرۆسەی پیشەسازی لەژێر لێکولینەوەیەکی زۆردایە لەم سالآنەی دوایدا، وە بە تایبەتی دوای گەشە هێنانی بەکار هێنانی ئەو تۆرە لەم سالآنەی دوایدا. لەم تۆێژینەوەیدا ئامێرکی ئەلکترونی دروست کرا، بەرنامەیەکی بەکار هێنانی ئەو ئامێرە، وە لەگەل بەرنامەی سوود وەرکرتن لەو دووەی پێشوو بۆ کونترول کردن لەسەر تۆری ئینتەرنیت یان نیتورك. ئامێرە ئەلکترونیە دروست کراوەکە دە بەسترێت بە پۆرتی چاپ کردنەوە. بەرنامەی ئامێرەکە بە زمانی C **نووسراوە. ئەو بەرنامانەی کە سوود لە تۆری نیتورك یان ئینترنێت دەبینێت بە زمانی** Java **نووسراون وە بە تایبەتی بە بەکار هێنانی** Servlet **لە زمانی جاڤا. بەکار هێنانی** Servlet **تازەیە وە پێشتر بەکار نەهاتوە وە دورمان دەخاتەوە لە زۆر لەو کەموو کووریانە کە لە زمانی** CGI **هەیە. زۆربەی توێژینەوەکانی پێشوو** CGI **بەکار دەهێنین نە ك** Servlet. **هەر وەها هەمو لا پەرەکانی کۆنترول** security **تیادایە وە هەر کەسیك وشەی نهێنی نەزانیت ناتوانیت هیچ کارێکی کۆنترول ئە نجام بدات.**

استخدام طريقة المستخدم-الملقم للسيطرة على العمليات الصناعية عن بعد.

محمد عبدالله حسين، كلية العلوم، قسم الكومبيوتر، جامعة السليمانية، اقليم كوردستان / العراق.
ممتاز محمد علي المختار، كلية الهندسة، جامعة النهرين / العراق.
وريا محمد علي، قسم البحث و التطوير شركة Communications S.A / فرنسا.

الخلاصة

ان استخدام الأنترنيت للسيطرة على الأجهزة ، المختبرات و العمليات الصناعية هو تحت الكثير من الضوء في السنوات الأخيرة وخصوصاً بعد انتشار استخدام الأنترنيت. في هذا البحث تم تصميم دائرة الكترونية بينية تُربط الى المنفذ المتوازي للحاسوب ثمكننا من السيطرة على الأجهزة و العمليات الصناعية. تم ايضاً تصميم برامج تمكننا من استخدام الشبكات و الأنترنيت للسيطرة على الجهاز المربوط بالدائرة الألكترونية المصممة. تتميز الدائرة المصممة بقلة كلفتها وتم تصميم البرامج بأستخدام لغة الجافا التي هي مجانية وأمينة. في لغة الجافا تم استخدام الـ Servlet للأتصال بين المستخدم و الملقم. تتميز الـ Servlet بكفائتها العالية و تخلصنا من العديد من المشاكل المتأصلة في الطرق التي تستخدم الـ CGI و منها السرعة و كفائة التجانس و التوثيق. تم ايضاً زيادة الأمان للمنظومة عن طريق اضافة كلمة سر لكل الصفحات الخاصة بالتحكم والأستفسار بالأضافة الى كلمة السر الخاصة بموقع DYNDNS الذي يتيح استخدام عنوان ديناميكي للوصول الى الكومبيوترات. البرامج المصممة تُتيح قابلية السيطرة اليدوية و الأتوماتيكية بالأضافة الى امكانية استخدمها للتحكم من بعد باستخدام الأنترنيت و الشبكات و التحكم المباشر في حالة وجود كافة الأجهزة في نفس الموقع .

Received on 22/4/2007 Accepted 12/8/2007
وەرگیراوە لە2007/4/22 پەسندكراوە لە 2007/8/12