Online Written Communication using Internet Protocol based on Virtual Instrumentation

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Abstract : Written communication in LabVIEW (Laboratory Virtual Instrument Engineering Work bench) refers to communication via internet where the user can write messages to another user. Generally written communication is not found in any programming related software but LabVIEW makes this possible using internet protocol. This helps in easy and fast transmission of data in form of messages between the client and server PC(s). After the transmission process gets over, the transmitted data is used for implementing PID controller. The various responses in PID controller are obtained by varying the tuning parameters. The responses are with respect to three conditions in the controller. On studying the response curves, parameters like setting time, rise time and maximum overshoot are obtained. A comparison table is obtained for these parameters and helps in deciding to choose the values for tuning parameters of the controller.

Keywords : *Networking, Data Acquisition, PID, TCP/IP, LabVIEW*

INTRODUCTION

Chatting has been always done via internet but not in any software. LabVIEW (Laboratory Virtual Instrument Engineering Workbench) offers the facility to chat and communicate in software. Here the internet protocol helps in communication that is Transmission Control Protocol (TCP).

In 2003, D.Poulton, et al. [1] discussed in their paper about the fading effects of rain on TCP/IP packet based satellite links and proposed a PID delay controller based on non-uniform sampling filtering. In 2006, A. Wei, et al. [2] discussed in their paper about TCP in Networked Control System (NCS) and performance of different types of data result. In 2011, F. Xiao, et al. [3] introduced in their paper about CAN-TCP/IP gateway showing the application of webserver in that field. In 2011, Z. J. Hong, et al. [4] proposed an acquisition diagnostic system for remote ground equipment using LabVIEW. In 2012, Y. Li, et al. [5] described about vulnerabilities of TCP/IP by exposing it to attacks. In 2007, S. Zhong, et al. [6] proposed a self-tuning algorithm for PID parameter using method of recursion least square. In 2009, A. Nazir, et al. [7] presented a genetic algorithm for tuning PID parameters which reduced the computational requirement. In 2009, J. Liu, et al. [8] presented a real time development system showing the control of position in a dc servo motor using PID controller. In 2010, S. Ravi, et al. [9] developed an ANFIS controller for plastic extrusion system which gave better performance than fuzzy logic and PID controller. In 2010, S.Mohammadi, et al. [10] developed a fuzzy based PID controller that helps in reducing the packet loss while TCP communication. In 2011, S. K. Sahoo, et al. [11] discussed in their paper regarding the modulus hugging approach for designing PI and PID controller. In 2011,

V. Kumar, et al. [12] discussed a comparative study on performance of various fuzzy PID with other fuzzy controllers.

The objective of this paper is to show the various advantages of internet protocols in LabVIEW. The advantages include communication like chatting, sending information, etc. Client and Server are two users that communicate using TCP/IP for sending their data. These data are used further in implementation of controllers. Here PID controller has been implemented and the various conditioned outputs are obtained. A comparison table is obtained with different outputs of the controller.

Rest of the paper is organized as; the Proposed System has been discussed in Section 2. Algorithm of the controllers has been described in Section 3. The simulation results along with discussions on it are presented in Section 4. The paper has been concluded in Section 5.

PROPOSED SYSTEM

Thesystem constitutes awoodenboxwhichis heatedbyaheating element. The main objective is to maintainthetemperatureinside this boxatsomedesired value of setpoint which is selected by Client. Fig. 1 shows the block diagram of Proposed System. The heating element i.e. a bulb is covered by a wooden box and on heating; the temperature is sensed by temperature sensor and is transmitted to the server PC with the help of DAQ card. Using the chat box on the front

panel of server, the value of process variable (PV) is sent to client PC using TCP/IP. The client PC on receiving PV sends set point (SP) value to the server PC. Depending upon the SP, PID controller takes the necessary actions. The actions are in the form of signals that control the operation of fan.

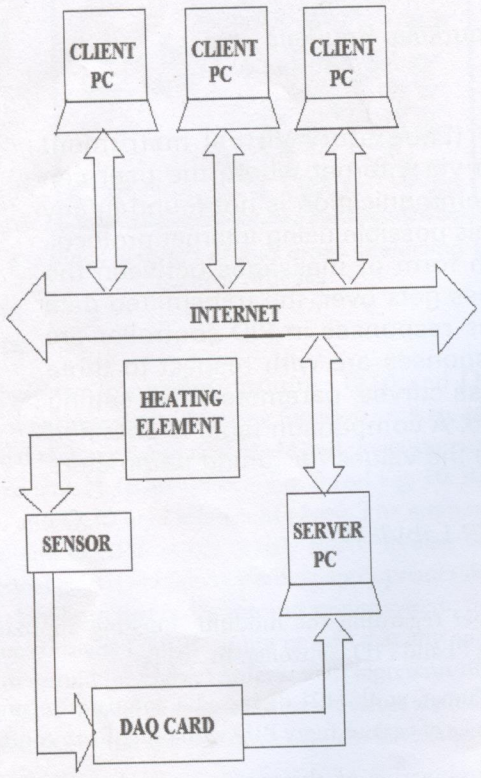

Fig. 1 : Block Diagram of the Proposed System.

ALGORITHM

The algorithm is described as follows,

a. The server sends message to client as "PV=40" which indicates that the value of PV (Process Variable) is 40. The next line have been send as "SP=?" which asks for the value of SP (Set Point).

b. The client on receiving message from server decides the value of SP. It sends SP as "SP=50".

c. The whole communication process is carried out using TCP/IP with port number as 6342.

d. With the values obtained any controller operation has been carried out. In this case PID (Proportional Integral Derivative) controller has been implemented.

e. PID controller operations has three different conditions as follows,
   i. Underdamped condition.
   ii. Overdamped condition.
   iii. Critically damped condition.

f. Initially T_i and T_d values has been set to zero.

g. The value of K_C has been increased until the output of the loop oscillates.

h. The value of T_i has been increased until any offset is corrected for the process.

i. The value of K_C has been increased if needed but too much K_C causes excessive response and results in overshoot.

j. By varying the values of K_C, T_i and T_d three graphs are obtained with three different conditions as discussed in 5.

k. Final tabulation has been done in order to obtain a comparison among these conditions.

RESULTS AND DISCUSSION

The front panel of communicating server is shown in Fig. 2. The server on finding the value of PV sends it to client by writing a message as "PV=50" in "Server Typing" box found in the front panel. On pressing enter while running condition, this message can be seen in "Server's Message"which shows the message server typed. This message is sent to client with port number 6342 and can be seen in "Server's Reply" box. The next message sent by server is "SP=?" and on pressing enter reaches client.

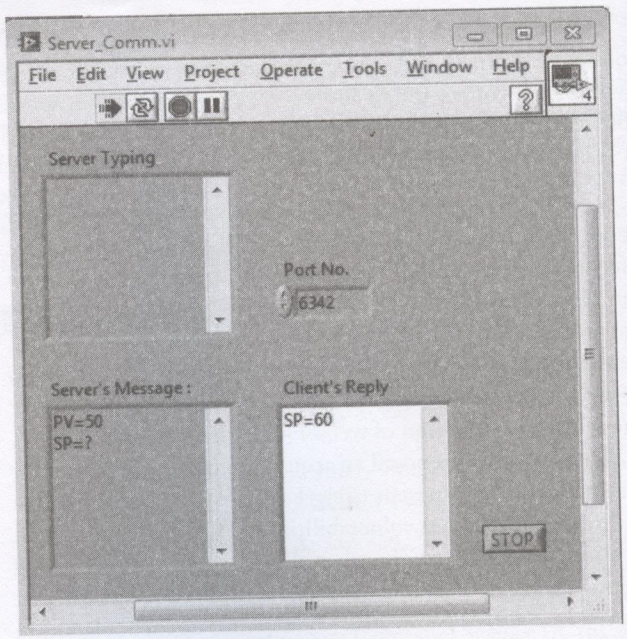

Fig. 2 : Front Panel of Communicating Server.

The front panel of communicating client is shown in Fig. 3. The client on receiving the value of PV sends the value of SP to server by writing a message as "SP=60" in "Client Typing" box found in the front panel. On pressing enter while running condition, this message can be seen in "Client'sMessage" which shows the message you typed. This message is sent to server with port number 6342 and can be seen in "Client's Reply" box.

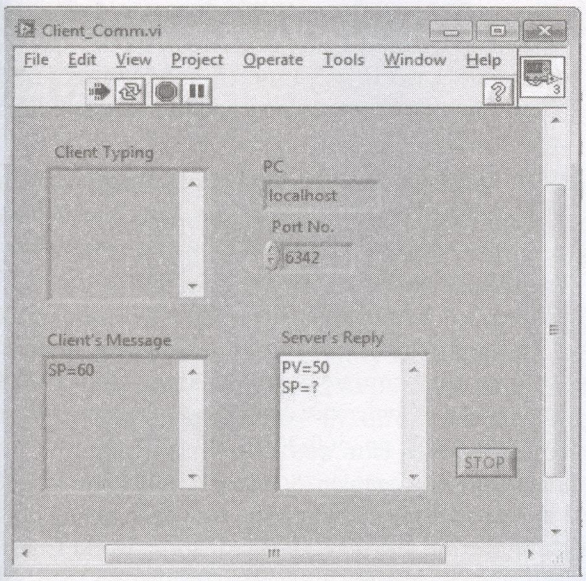

Fig. 3 : Front Panel of Communicating Client.

There are three conditions of response and they are, critically damped, overdamped and underdamped. These responses have been obtained using manual tuning of PID tuning parameters. Fig. 4 shows the critically damped response of PID controller. This is the manual tuning results where the values of tuning parameeers of PID controller, K_C T_i and T_d have been tuned to 3, 0.048 and 0 respectively. It is clearly seen that the PV is controlled to its SP value with less time. The value of process variable obtained was 60.00.

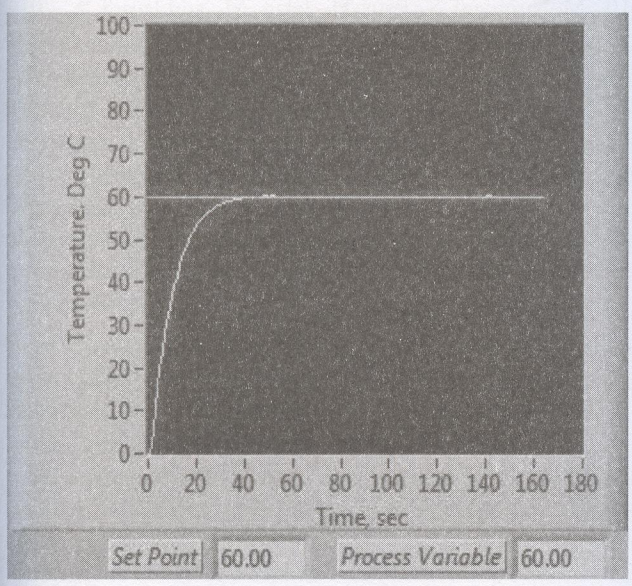

Fig. 4 : Graph showing critically damped response.

When K_C, T_i and T_d have been tuned to 3, 0.006 and 0 respectively, underdamped response have been obtained. The graph is shown in Fig.5. The value of process variable obtained was 60.05. An overshoot peak is observed and immediately follows undershoot which tries to stabilize the curve.

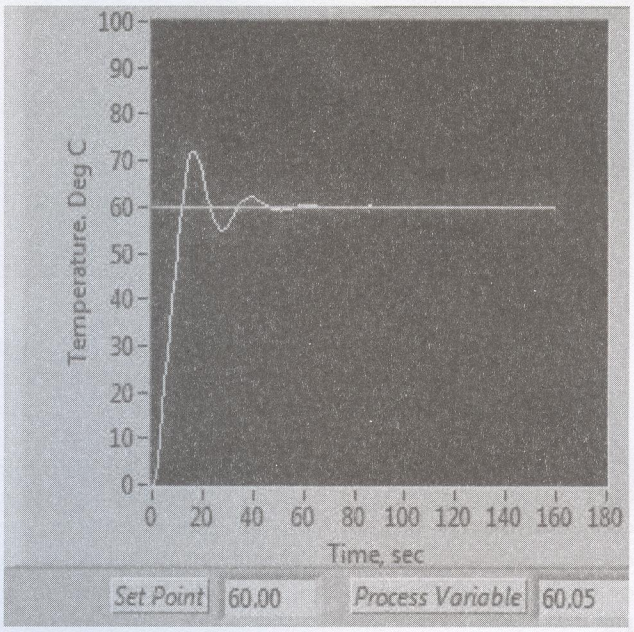

Fig. 5 : Graph showing underdamped response

When K_C, T_i and T_d have been tuned to 3, 0.08 and 0 respectively, overdamped response have been obtained. The graph is shown in Fig. 6. The value of process variable obtained was 60.06. For individual response, their corresponding rise time, settling time, peak overshoot have been obtained.

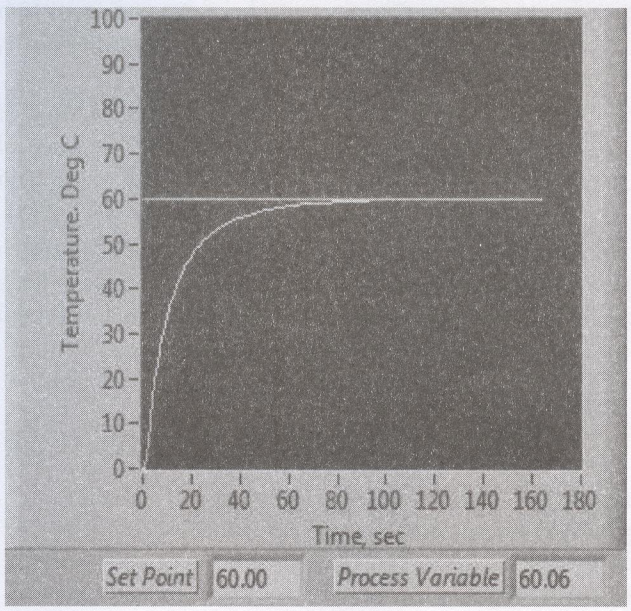

Fig. 6 : Graph showing overdamped response

Table 1 shows the comparison between the three response curves with respect to their curve characteristics.

Table 1. Comparison between response curves

Response Curve	Outputs of different conditions		
	Rising time	Settling time	Maximum Overshoot
Critically damped	21	40	0
Over- damped	35	72	0
Under- damped	10	56	12

So, the final values for PID parameters were chosen as 3, 0.048 and 0 respectively.

CONCLUSION

Online communication by TCP/IP is applicable to various applications like transfer of data or message, written communication/chatting, etc. The comparison table of response curves gives the values of rising time, settling time and maximum overshoot. These values are helpful in choosing the tuning parameters of the PID controller and implementing automatic control process. PID controller response is faster and stable than other controllers. The application of TCP/IP can be extended to multiple accesses by client and server, service tasks, etc. The graphs obtained can be published in web browser using HTTP, can be sent from one user to another by using FTP (File Transfer Protocol), e-mails, etc.

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