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Virtual Remote Lab Access over TCP /IP Server

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ABSTRACT: Nodes Remote laboratories for motion control are valuable tools for teaching mechatronics students since they represent various industrial applications. Applications of advanced control algorithms in remote laboratories are rarely described in literature. Their real time implementation in FPGA environment is a complex and time-consuming task. This paper describes the National Instruments LabVIEW utilisation in such a remote laboratory, where H-infinity control algorithms are successfully implemented. Its main focus is on the functionality of the remote application and its graphical user interface.

KEYWORDS: Mechatronics, LabVIEW, H-infinity Control Algorithms, Server, Virtual Remote Lab

I. INTRODUCTION

Over last decade with a remarkable growth of computerized laboratories for educational purposes, in particular those for motion control. They represent an ever expanding field in a variety of industrial applications and emerge as a valuable tool for performing real time experiments with usually expensive or unique laboratory equipment in a safe way. The development and constant improvement of software applications such as National Instruments LabVIEW and Math works MATLAB allow easy implementation of control algorithms and creation of user friendly GUI interfaces with virtual instruments (VI). Increased Internet speeds and reliability of connection contribute to the expansion of remote laboratories where users can connect to the laboratory workbench from a distant location and perform an engineering experiment. This allows laboratories to be shared between client and user greatly increasing their economical sustainability and usefulness. The work discussed in this project fall into the category of motion control.

A comprehensive platform, using three test benches for control of DC, BLDC and stepper servomotors with particular attention to a DC motor servo system with controlled motor load, is demonstrated in. As far as motion control is considered, we go for Brushless DC motor. Here the designing of the experimentally based control course for remote laboratory presents.

The basic goal towards the work is to design a TCP/IP communication interface based on LabVIEW. Previously the work presented here is compact on FPGA environment. With aid of FPGA or MATLAB based technique the system quite complicated with its constraint parameter like speed of motor, time delay etc. Even working with algorithmic design the system is tedious to control. LabVIEW provide architecture approach to control the parameter for motion control.

The main objective of the work is used of LabVIEW software development platform, shared with Arduino and TCP / IP communication protocol to accomplish a long-range data gather and completed a time and frequency domain analysis also it compared with the straight data acquisition and processing system, it has the advantages of a cost-effective, high uniqueness, easy-to-improvement, data processing easy, short development time, the use of high-quality results.

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II. REMOTE CONTROL STRATEGIES

The easiest way of remote monitoring and control is to use Remote Desktop of Windows System instead of specific agreement in particular application. Remote Desktop constitutes server-side and client and can control one another. The system has two computers, one server and other one is the client. The server computer collects data, store it for transmission later on and remotely control device parameters in real time; the client desktop receive data, process it and display. The system also uses data transmission equipment, data acquisition cards and sensors such as bus. Hence, this system comprises of sensors, signal conditioning board, USB serial bus, on-site data collection computer, and transmission networks and remote data processing and analysis computer.

III. TO COMMUNICATE USE OF NETWORK PROTOCOL

TCP / IP protocol is primary and reliable Internet protocol to control the flow of information using internet. LabVIEW supports TCP / IP protocol to achieve data communications. There are two sub-templates given for TCP / IP protocol communications function, one is the TCP template for functions based on the TCP protocol communications.. In this way LabVIEW uses communication for remote data collection between the client and server. In client, firstly, used TCP Open Connection node function to open a TCP connection which the remote port the server were designated. TCP Read node function receive the data transmitted by the server and then tested and processes it. Port must be same during sending and receiving process. Process diagram was in

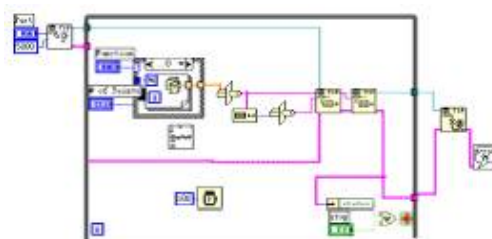


Figure 1. TCP / IP send procedure

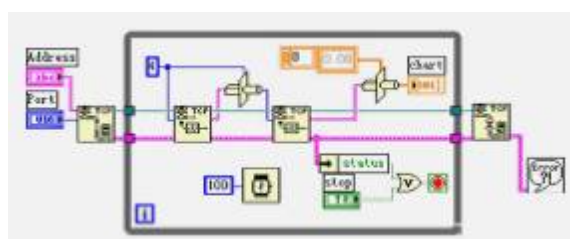


Figure 2. TCP / IP receive procedure

In the TCP / IP protocol, the port is a structure, constitutes abstract data structures and buffers. Port function is same as to file I / O operations, the port can both be read or written. In order to solve Different types of communications between the host process, we require a rival process of the network environment which can determine the port number and IP address.

eq. (3)

IV. SERVER CLIENT BASED ON LABVIEW

Web applications preferably use Client / server model. In client / server model, a set of clients request for service to server. The functions which VI Client performs are enlisted below:

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- Client program creates a connection with a server program;
- Send orders to the server;
- Collect a response;
- Close the connection.

V. DESIGN AND IMPLEMENTATION

In this work, an effort is made to monitor and control the motor through TCP/IP connection using virtual instrumentation, LabVIEW. A web server is a system which hosts a web site and provides services for any requesting client. The server system which contains hardware module which is connected to the internet so that motor can be monitored and controlled from remote places, the client system runs on LabVIEW platform is also connected to the same internet. By typing the IP address of server system on the client side the user gets connected to the remote system and precedes the monitoring and controlling process. Here the command is entered in PC with LabVIEW which is used as interface software for communicate with Arduino by accessing the IP address of server system. With the help of LABVIEW software the system provides high accuracy and flexibility

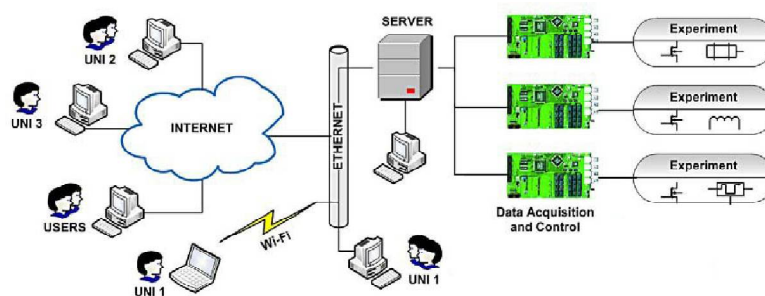


Fig. 3 Remote Laboratory establishment over Internet Generic Structure

Based on the above design, the following objectives for further development are considered:

- Establishment of a methodology for motion control to distant user.
- Development of Virtual Instruments in LabVIEW environment. Development of necessary infrastructure of web server, application server and TCP/IP communication and data transfer.
- Development of a client interface on the web.
- Tests process to determine the real-time capabilities of the system and implementation of corresponding improvements.

VI. REMOTE LABORATORIES USING LABVIEW

Remote control system is realized using LabVIEW (short for Laboratory Virtual Instrumentation Engineering Workbench) is a platform and development environment for a visual programming language from National Instruments. LabVIEW is commonly used for data acquisition, instrument control, and Industrial automation on a variety of platforms including Microsoft Windows, various flavors of UNIX, Linux, and Mac OS. The main idea behind the remote control system is to access and control the speed of motor from a distant place using suitable communication method.

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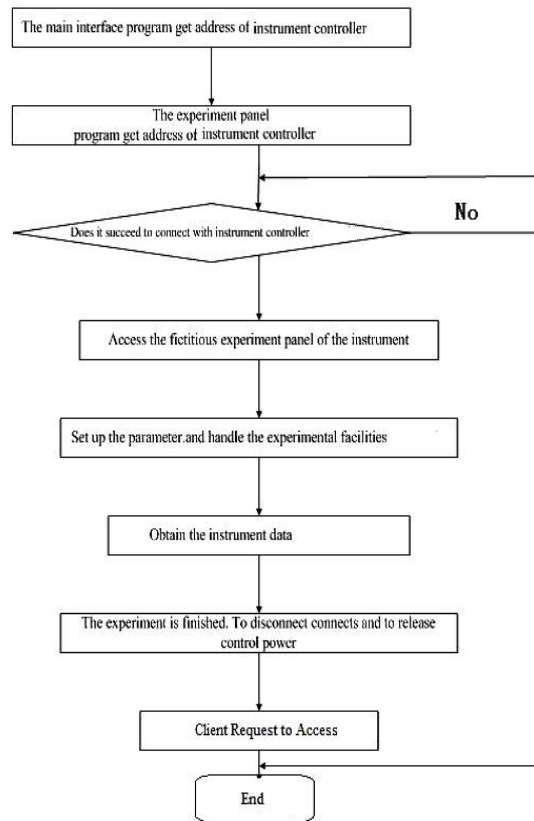


Fig. 4 System flow

VII. EXPERIMENTAL RESULT

By using PC with LABVIEW act as a web server it is connected to the internet and the whole device is connected to remote PC through internet. The software designed in LABVIEW offers high flexibility for dynamic user requirements and variety of data to be acquired. We have introduced the general design concept of the web server and the policy of TCP/IP reduction, special the reduction of TCP, whose goal is to allow easy access to and exploitation of remote equipment.

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Fig. 5 Real time implementation of TCP/IP



Fig. 6 LabVIEW front panel of Motion control

VIII. CONCLUSION AND FUTURE WORK

For remote connection of the web-client (representing the remote user) and motion control of the experimental workbench are proven feasible to be realized – LabVIEW Web Services and Remote Front Panels. The use of LabVIEW software development platform, joint with data acquisition and TCP / IP communication to attain a long-range data collection, and finished a time-domain signal study and frequency domain investigation. Compared with the established data acquisition and processing system, it has the reward of a lucrative, high universality, easy-to-development, data dispensation simple, little development time, and the use of good outcome.

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