Implementation of a Multi User Secured Remote Data Logger for Real Time Hybrid System

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Abstract

Objectives: This study aims at designing an easy and a secured way of remote server based data logging using a data acquisition mechanism and HFS (http File Server) software. **Methods/Statistical Analysis:** Lab VIEW based remote data monitoring and controlling system is designed so as to view and analyze the fidelity of the data. This mechanism proves to be a secured data logger providing an increased access to the users in the loop, along with time stampings and many other additional features. A real time nonlinear process system was considered as a bench mark system for the purpose of logging the level data of it remotely. The Dual Spherical Tank Liquid Level System (DSTLLS) has been chosen and its continuously varying liquid levels are recorded and monitored remotely over the LAN, using remote Master-Slave architecture and File Transfer Server. **Findings:** It was found that these methods of the data logging prove to be faster and cheaper when compared to the existing methods. Classical algorithmic approach for the data transfer is being applied to facilitate the data logging process. **Application/Improvements:** There is scope of performing experiments on the data transfer mechanisms using different algorithms and analyzing their performance and efficiency in data logging process.

Keywords: DPT, HTTP File Server HFS, Lab VIEW, Process control, Remote Control

1. Introduction

Monitoring and controlling are the major factors involved in all the automation industries, for this the industries are spending huge amount of money as well as man power to keep the company running in optimal manner and gain profits. But the problem comes with the 24/7 service providing which can't be possible in some situations such as the industries like nuclear power plants and chemical industries need round the clock services for monitoring and controlling and if any emergency situation arises then the entire scenario may lead to disaster or calamities. So present paper deals with online monitoring and controlling of the system which also can be hand over to other users on request or necessity. Monitoring and controlling of Industrial processes are more costly in terms of physical area, man power, money, power consumption, and speed. In[1] have developed a data logger used for detecting, collecting, monitoring and wirelessly logging data of temperature and humidity in the hospitals. In[2] deals with process monitoring via intranet. HFS (Http File Server) is a software which is used for file sharing purpose. HFS allows users to view the continuously updated data from the remote location. This software is flexible and compatible to every operating system like Linux. The user can interact with the updated files through that generated URL. The file is updated for every second of time in the LabVIEW and in the web. The design of a zigbee based monitoring and controlling system for induction machine which works for a short distance of communication has

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been implemented[3]. The development of a project of wireless monitoring and controlling of real-time data using Nuvoton Development board having ARM Cortex M0 as processor Interface (GUI) based on visual basic 2012 software[4] has been witnessed. Conventional Methods included humans to monitor the data which is now replaced by unmanned embedded devices which acquire data and process it to useful form and transmit either wired[5–8] to address the need of low power supply in the literature. Data is logged every time it is received and a log is maintained in PC. Dynamic, real time and efficient web based experiment platform design for control engineering education is presented in the literature[9–11]. The LabVIEW program is written in such a way that it will read the values of level of the process tank continuously through the DAQ card and the same will be uploaded into the web. The evidences of the need to log the data continuously and monitor the data to control typical industrial systems are found in current day and they play a pivotal role in data driven and intelligent control[12–17].

2. Experimental Process Description

The process control setup has basically a two tank system which has different inflow and outflows. There is different pneumatic valves to operate manually and automatically with pressure. Compressor is used to produce the pressure which helps in closing and opening of the valves. There exists a separate intermediate valve in between the two tanks. The setup has a rotameter which measures the inflow rate in LPH (litres per hour).

DPT is attached to the system which is basically a differential pressure transducer sensor of 4mA-20mA range which shows the level of the water in the tank in terms of current (mA). It will give the current value to the respective level of the tank. The setup also has I/V (Current to Voltage) and V/I (Voltage/Current) converter. Generally I/V converter used at the input state because the DAQ system uses voltage as a input but the DPT is current sensor so to convert this current to voltage I/V converter is used. Figure 1 shows the experimental setup of a process control system. And the V/I converter is used to operate the input pump valves which are operated by current, so the desired voltage is given in the system through DAQ to pumps. The process control operation starts with the compressor by producing pressure to the pneumatic valve

it will regulate the inflow. Table 1 shows the technical specifications of the process control setup.

Figure 1. Real time experimental set up of the process control.

Table 1. Technical specifications of spherical tank system

Hardware parts	Description
Dual Spherical Tanks	Material: Stainless Steel Diameter:45cm
Differential Pressure Transmitter	Type :Capacitance Range :2.5 to 250)Mbar Output :4 to 20 mA Make :ABB
Control valve	Size :1/4",Pnematic Actuated Type :Air to close Input(3-15)PSI 0.2-1 Kg/cm2
Air Regulator	Size ¼" BSP Range:(0-2.2) BAR
Pump	Centrifugal 0.5 HP
I/P Converter	Input:4-20 mA Output :(3-15)PSI
Pressure Gauge	Range:(0-30) PSI Range :(0-100) PSI

3. Methodology

This state will describe the actual methodology of the total data logging system. The exact working of all components is explained in the sections further. The data acquisition card continuously read the present level of the

tank that file is stored and uploaded into file server. Then it is possible for the multiple user to access the file with the help of generated URL.Controlling from remote location is done through the remote front panel for that it is required to give the control to the specified client with the host system placed at the real time setup. Figure 2 demonstrates the block diagram explanation of the data logging strategy employed.
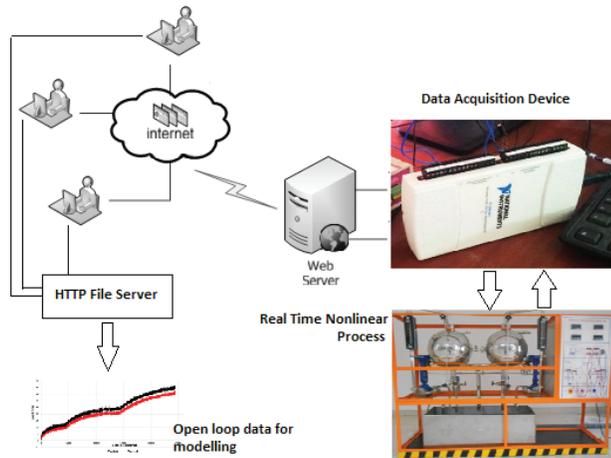

Figure 2. Approach to the data logger mechanism.

3.1 NI-DAQ-6211

NI-DAQ-6211 is Data Acquisition card which is used to acquire data from sensor directly and also can be used for actuators. It consists of 16 analog inputs of 16-bit and two analog outputs of 16-bit and also 4 digital inputs and outputs also two 32-bit counters. It is compatible with LabVIEW, Lab WINDOWS/CVI and Measurement Studio for Visual Studio.Net.

3.2 Level Sensor

Differential pressure transmitter gives the output current (range 4 to 20 mA) proportional to the present level of the liquid in the tank. As mentioned the setup maximum capacity is 45 liters. For example the present level of the tank is 45ltrs then the output of DPT is 20mA.similarly it will give the output current to the respective level. That will be given to the IV converter that will convert the current to voltage. The DAQ system will reads the voltage and sends to the LabVIEW.

3.3 I/V Converter

External I/V converter is required to convert the current to voltage because the here the DPT gives the output as a

current, So to convert this current to respective voltage I/V converter is used.

3.4 Role of LabVIEW

LabVIEW is widely used in the process control industries. Here the LabVIEW is programmed in way that it will read the values from the sensor and it will upload all the input sensor values to the excel sheet. For that it is required to specify the path to store values in the excel sheet. The excel sheet consist of the time and the respective voltage to the present level. The excel sheet is updated for every iteration. It is fully based on the user selection.

3.5 HTTP Fileserver

It is open source software used to send and receive the files via intranet. It is different from classic file sharing because it uses web technology to be more compatible with today's Internet also run on different operating systems like windows Linux etc. And also it will compatible with the different browsers. In this it is possible to create different accounts for different users. This will provide the security to the uploaded documents by providing the password. This software is very simple and reduces the complexity of hardware.

4. Results And Discussions

The remote data logging has been performed using two methods, viz..; Using HFS module and LabVIEW remote connection manager

4.1 Data Logging Mechanism using HFS

At the uploading state it will gives to options real folder and virtual folder. Based on the requirement real or virtual folder will be selected. After selecting that it is possible to upload the files into the web. Here the folder setpoint consist of excel sheet which is taking values from the DAQ system. That folder is uploaded as a real folder and it will updated for every iteration. Figure 3 and Figure 4 shows the creation of user account in HFS and it is possible to protect the data using password. Here this will give the information about the user requests from the remote location and it will give the file size and the data rates of uploading and downloading. It will give the information about the number of hits by the remote user.
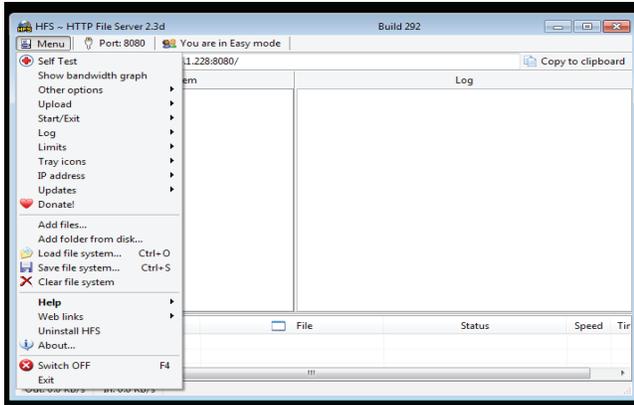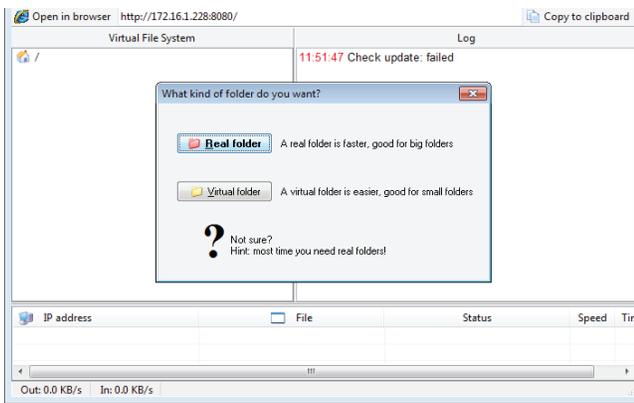
Figure 3. Different features of HFS.

Figure 4. Uploaded folder type.

Figure 5. Shows the log of the information shared by the client and it will be displayed with time and no of hits with the respective data rates.
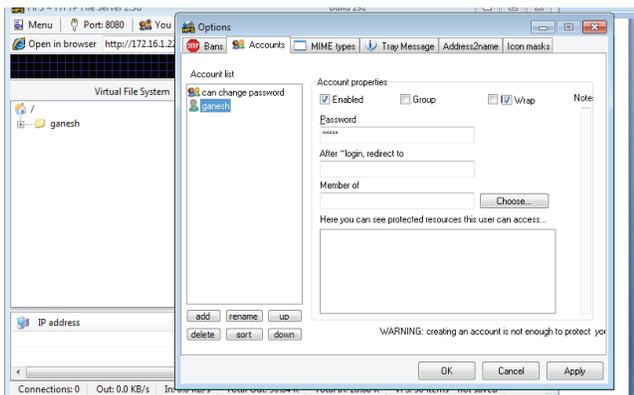

Figure 5. User account creation for security threat.

Figure 6 Shows the down-loadable link at the client system when click on that link it automatically starts downloading for example in the Figure 7 modelling.lvm

is a name of the file if the client see the process values from remote location by opening that file they can see the status of the file. It will also have the information of no. of downloads till that particular time. Figure 8(a) shows the data log at the server system. It shows the permission requests, data rates and it contains the IP address of the client at the respective time.Whenever the user downloaded the file then the hit count will be increased and the data log at the server also changed. Figure 8(a) shows the log interface for the data file. In the Figure 8 (b) the log file shows the ip address of multiple users. HFS allows to share the data to multiple users. The log has the time and IP address of the different clients.
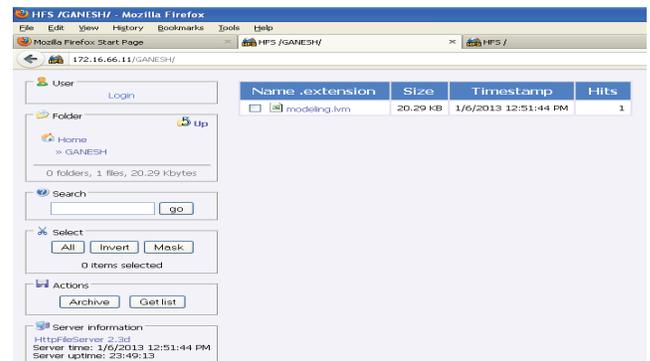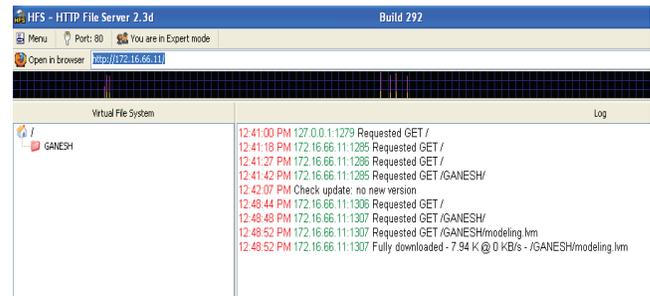

Figure 6. Data log at the client.

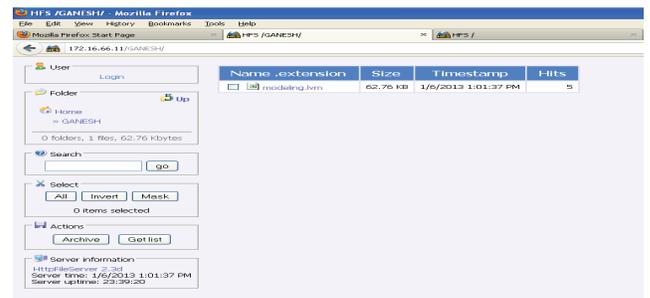**Figure 7.** Data log at the server.

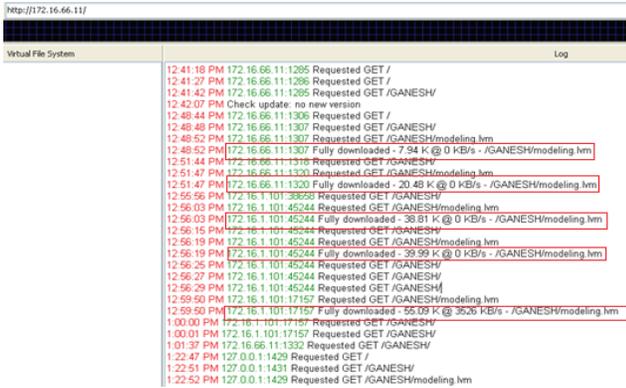**Figure 8 (a).** Data log at the client after downloading file by multiple users.

Figure 8 (b). Data log at the server after downloading file by multiple users.

(b)

Figure 9. (a) Server control with a last message. **(b)** Server control transferred to the client.

4.2 Data Logging Mechanism using LabVIEW Remote Connection Manager

By the HFS based design used only for the monitoring. The remote panel is a tool in LabVIEWby which the client can access the front panel and based on the server decision there is possibility for the server to give the control to the client. The Figure 9(a) and Figure 9(b) shows the different control options in LabVIEW.
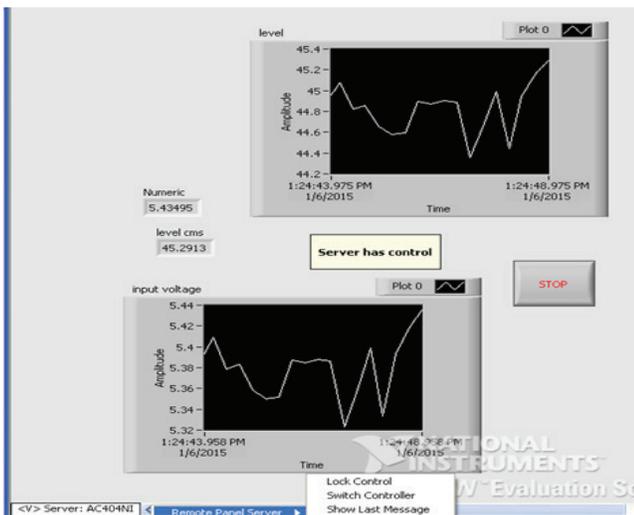
The sever system also has the traffic controlling in LabVIEW. For example if the user view the status of the system in the web browser, it will show the indication in the remote panel connection manager.It will display the client name who is currently viewing the data; Figure 9(a) and Figure 9(b) shows when the client is accessing the data.

Figure 10 is the traffic analysis at the host system and it is possible to connect with the multiple clients for monitoring; the controlling is given to on client at a time. For example client A is having the present control at that time if client B wants to control, it is not possible for the client B to take the control. At present time the client with name AC404 NI is sharing the connection and it is only viewing the front panel in the browser. But it cannot receive the control from the server system. Figure 10 shows the data rates along with thespeed at which the clientsare accessing the data from the server. Whenever the server disconnected the client unable to see the front panel. Graphical user interface for the spherical tank system is shown Figure 11 which demonstrates the GUI designed in National instruments LabVIEW and it is configured with the server system so that the client understand it easily.
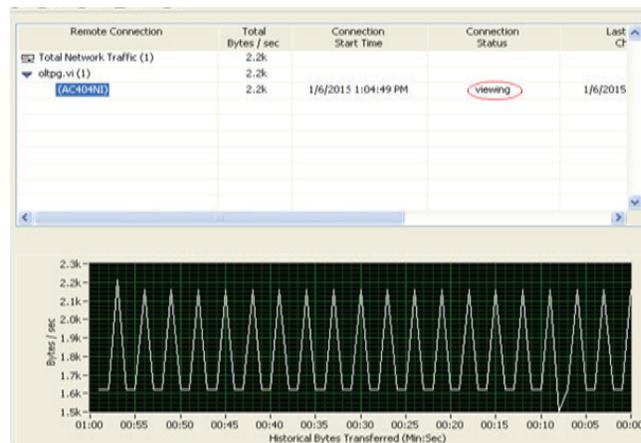

(a)

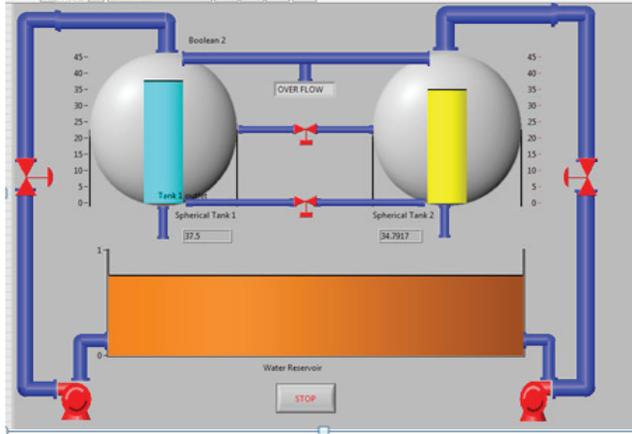**Figure 10.** Remote panel connection traffic analysis and Client Status.

Figure 11. GUI with remote connection manager.

5. Conclusion

In this article, LabVIEW based remote serving mechanism was implemented, where in a real time industrial Single Spherical Tank Liquid Level System was interfaced and its varying level parameter has been monitored remotely using a HTTP file server mechanism and graphical remote LabVIEW interface.An interactive GUI was also designed and was interface with the remote web viewer on LabVIEW. It can be concluded that, these kinds of remote monitoring, data logging and controlling mechanisms, add an additional access to any industrial process, thus easing the data operations in real time.

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