CSE 4342
Project Lab

Design of a Real-data Data Acquisition System with Network Communications

Overview

This Lab will consist of four parts, real-time data acquisition, pre-processing (filtering), network communications and recording the communicated acquired data. You will use Windows threads and Windows sockets to transmit and receive data over the network. You may work in groups of two. Code can be the same; however, your write up should be in your own words.

Objectives

1. Design a real-time data acquisition System using the Windows platform and the Data Translation DT9816 to convert analog data to digital values, preprocess this data, and then send it to a client program via Windows sockets.
2. Two programs will be developed, one for the Client and the other for the Data Acquisition Server Program.
3. The Client program will be responsible for interfacing with a user and signal the Data Acquisition Server to begin processing.
4. The Server will (upon command received from the Client) begin acquisition, preprocessing of the data and sending the processed data over the network to the Client.
5. Your finished system will include complete documentation of the design, including a block diagram of the Client and Server module, illustrating necessary modules and components. The Server module will consist of an embedded PC, A/D module, signal conditioning and power module.

Notes

1. Your system will build on the real-time data acquisition system developed in previous Labs. That is, upon a command received from the server, it will continuously sample two channels, a sine wave, and a 'begin processing switch'.
2. The Client will first communicate with the User or operator asking for the 'Sampling Rate', filter coefficients and the 'File Name' for the received data. The Client will then send the 'Sampling Rate' and filter coefficients to the Server. The Client will wait for the User to signal start data collection. When commanded to do so, the Client will then send a 'Start' command to begin sampling to the Server.
3. When the Server program is invoked, and receives a command from the Client, it will first initialize the A/D converter for continuous A/D sampling at a rate specified by the Client

4. When the ‘Start’ command is received from the Client via the network the Server will begin sampling at the specified rate, ignoring channel 0 and monitoring channel 1, which is connected to the ‘begin processing switch’. When this switch is asserted, the program will first turn on the LEDs (‘Processing Indicator’) and then begin continuously sampling the channel 0 sine wave and the channel 1 ’begin processing switch’.
5. When the switch is asserted on server side, a message must be sent to client to indicate the start of processing or start signal. As long as the switch is asserted, the server will capture, filter and compute the average, variance, maximum and minimum values of the filtered data after each buffer is read. It will then send the processed data to the client.
6. When the switch is negated, it should finish processing the last buffer received and send the results to the Client.
7. The Client will continue to receive and store the data to a user specified file until it has written the last buffer. The Client will then signal the server to terminate and the Client will terminate.
8. Accordingly the LEDs should indicate which operation is being performed.

LEDs:
0 0 – System not on
0 1 – System acquiring Data
1 1 – Data collection complete; Data filtered and transmitted successfully.

9. To test your system,
a. Connect channel 0 of the DT 9816 to a 90 Hz sine wave signal, the ‘beginprocessing switch’ to channel 1, and the LED (‘Processing Indicator or Status’) to the digital output channel Pin’s 0 and 1.
b. Invoke your programs as described with a sample rate of 2000 Hz. Compare your results with the results with the filtering assignment you were given.
c. You may use one of the other PC’ s or your notebook for the Client, but for your final demonstration you must use the PC’s in the Lab.
10. The Project Lab documentation is due by May 7. You must demo your program on or before that date to Vikram. Vikram will typically be available in either ERB 201 or your Lab, Mondays-Thursdays from 11:00-4:00.

Deliverables

1. A circuit diagram.
2. A block diagram of the server module, indicating all components for an embedded module. Your embedded module will include, an embedded PC for performing the server function, signal conditioning that includes an analog filter, and a power module. In your design, indicate the analog filter selected with parameters.
3. A flow chart for your software processes, including the client/server module relationships.
4. Your working project.
5. Analysis of the entire system, with additional comments on how to adapt the Server side filtering based on coefficients sent by the Client.

Lab Evaluation

Your solution will be evaluated based on the following criteria:
1. Your lab instructor will provide a sample rate and indicate the input frequency. You are to use the resulting output for your assignment.

2. Provide a description and circuit/block diagram of the system.
3. A description of your program.
4. The source code (can be the same for each two member group).
5. The computed statistics received by the client (indicate the filter used and sampling rate).
6. Record keeping: Provide documentation detailing time spent on each task, problems encountered, solutions, etc.
7. The quality of your deliverables
8. The quality of your design, demonstration, and final results.