Belachew Haile-Mariam
CSE 4342—001
5/12/2015

Partner: Kevin Marnell

Final Project Lab Assignment

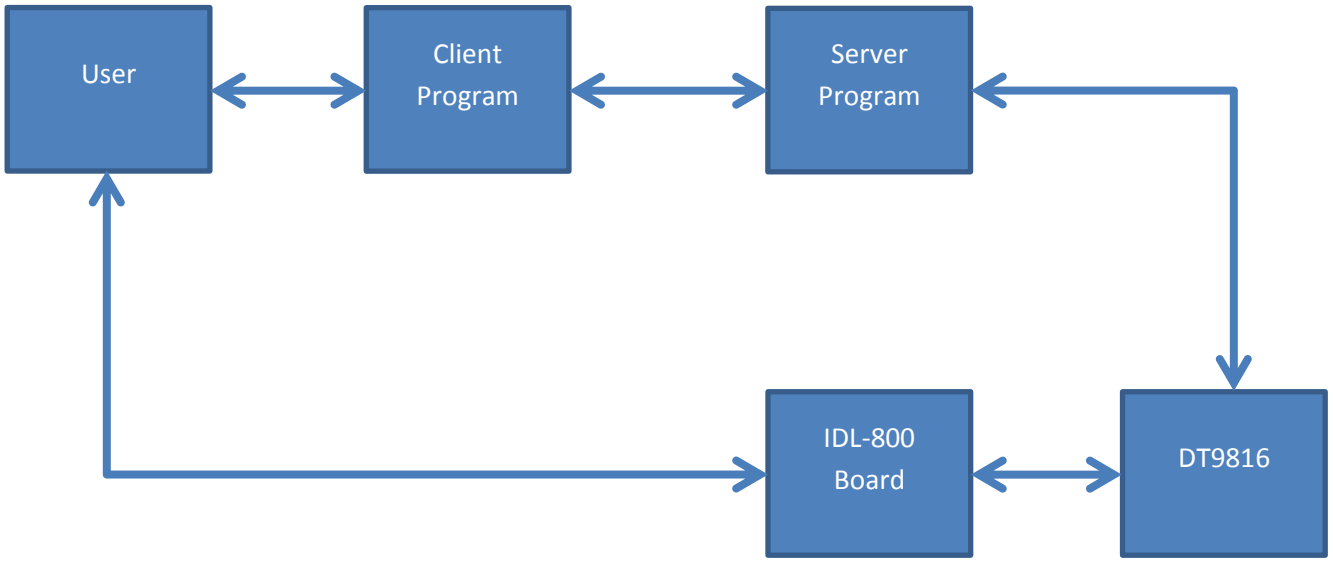
1. Name and ID

Name: Belachew Haile-Mariam
ID: 1000724901

2. Description of the System

This lab demonstrates the use of network communication via windows sockets, real-time data acquisition, and signal processing with an FIR filter. Two programs, a client and server, begin on two different computers. The client program takes in the following input from the user: a file name of filter coefficients, the sampling rate to use with the DT9816, and a begin command. The coefficients and sampling rate are relayed to the server program immediately upon receiving them. Upon receiving the begin command, the client sends a start command to the server program, and data acquisition begins on the server. The server interfaces with the DT9816 board and reads the analog input from input channel 0. When input channel 0 is switched to 5v, the server stops reading the analog input and begins reading analog input on analog input channel 1, which is hooked up to a sinusoidal wave generator. As long as input channel 0 is asserted to 5v, the server continuously reads in each buffer of the wave, processes the buffer by convoluting it with the coefficients and values from the previous buffer, and sends the values back to the client. The client saves these values to a .csv file. In addition, the server sends the current maximum value, minimum value, average of values, variance of values, and sum of values from the processed data to the client. When the input channel 0 is toggled, the server will pause and resume the data acquisition process. When the user types “STOP” on the client program, a stop command is sent to the server and both programs terminate.

3. Block Diagram of the System



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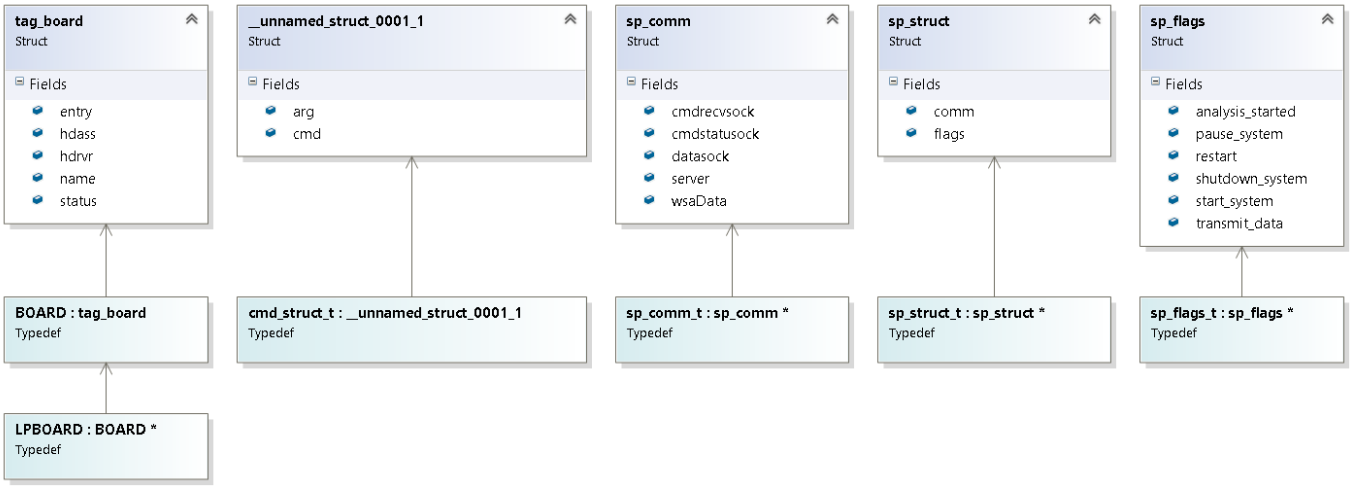
4. Class Diagrams of the System

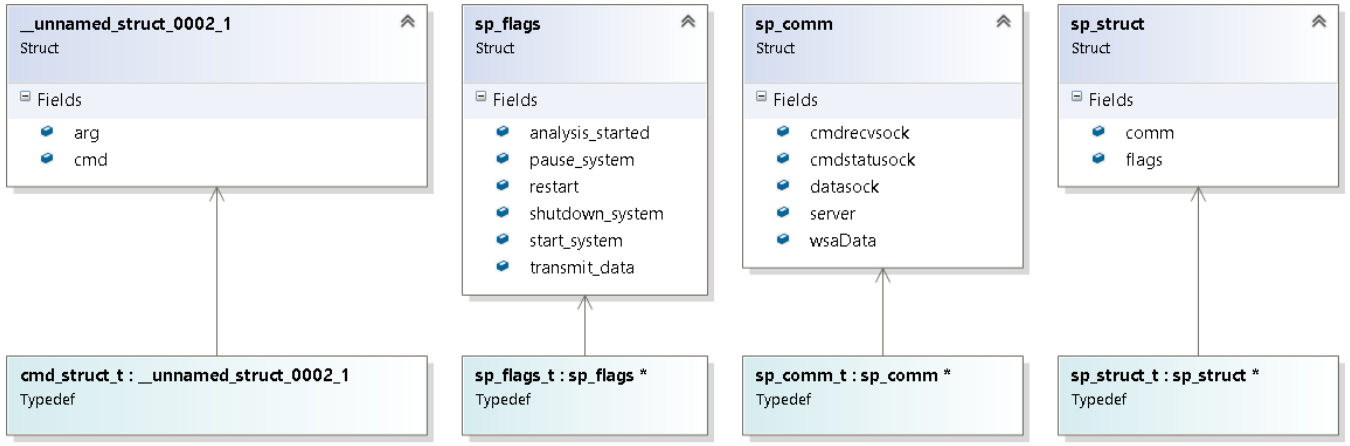
a. "DtConsole.cpp" Class Diagram

** This is the Server Code



b. "Rx.cpp" Class Diagram

** This is the Client Code



5. Source Code

The source code files for this assignment are included with this lab write-up in this folder. The file name for the Server is "DtConsole.cpp". The file name for the Client is "Rx.cpp".

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6. Description of my Programs

My solution for this assignment is split into two pieces of code—"DtConsole.cpp" and "Rx.cpp". The DtConsole program acts as the server and the Rx program acts as the client. The two programs communicate over a network using windows sockets and multiple threads. Each program has a secondary thread that is constantly listening for communication from its counterpart.

The client code interfaces with the user via the command prompt window. The server interfaces with the DT9816 module. When the server receives the START command from the client, it begins polling the analog input 0 on the DT9816 (which is hooked up to a switch on the IDL-800 board). When this switch is asserted to 5v, the DT9816 begins to monitor the input on analog input channel 1 (which is hooked up to a signal wave generator on the IDL-800 board).

The server code takes this wave signal from this input channel and reads it into a buffer. The buffer is then convoluted with a set of coefficients that was previously sent over to it from the client program. The output of this convolution is used to compute the maximum value, minimum value, average, variance, and summation of the values. The computed statistics and the contents of each buffer is continuously sent back to the client to be saved into files for later review.

7. Computed Statistics Received by the Client

**The following waveforms show the input/original, filtered, and combined signals encountered in this project assignment.

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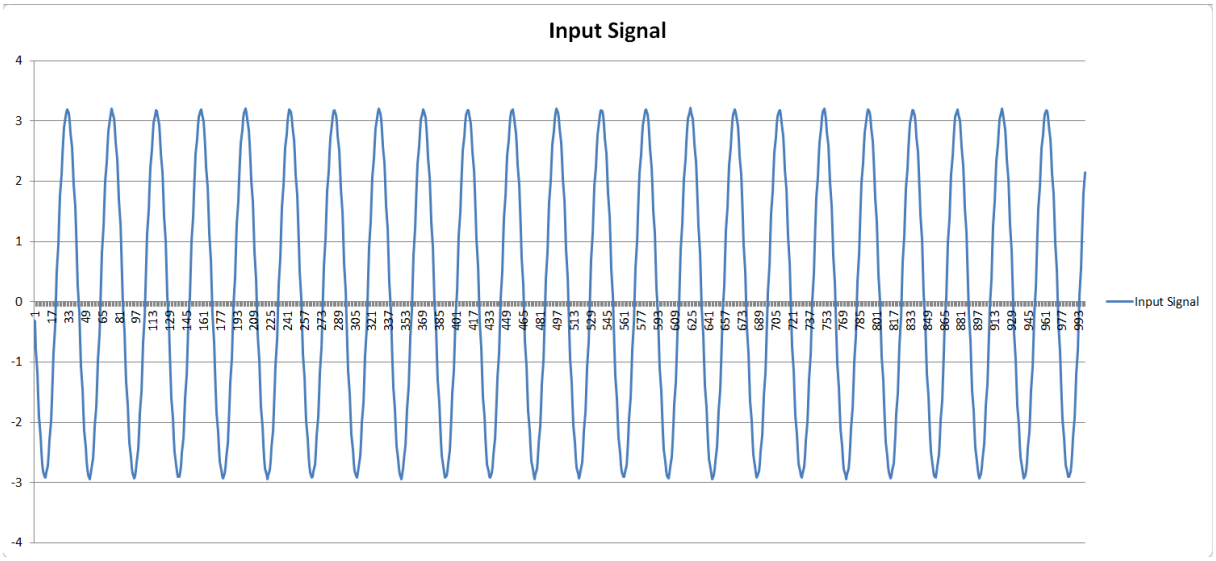
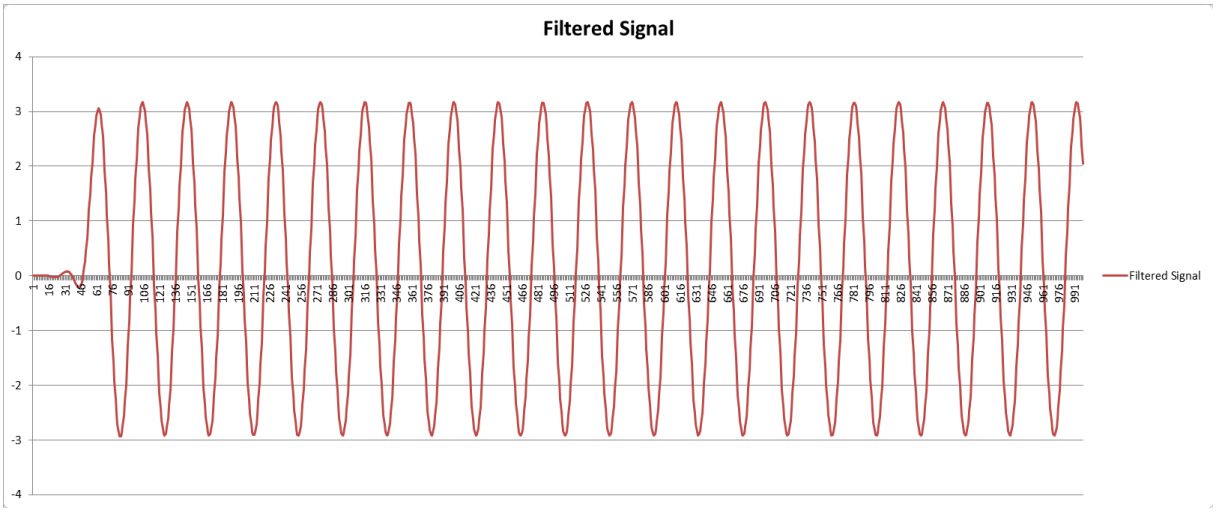
a. **Input (original) Signal**—this wave was inputted to the DT9816 from the wave generator on the IDL-800 board.
**The sampling rate used for this signal was 2000 Hz



b. **Filtered Signal**—this signal was produced by the server program by convolving the input signal with the coefficients inputted by the user on the client program.
**This signal was created by convoluting the input signal above with the “Coef.txt” file of coefficients.
**The sampling rate used for this signal was 2000 Hz



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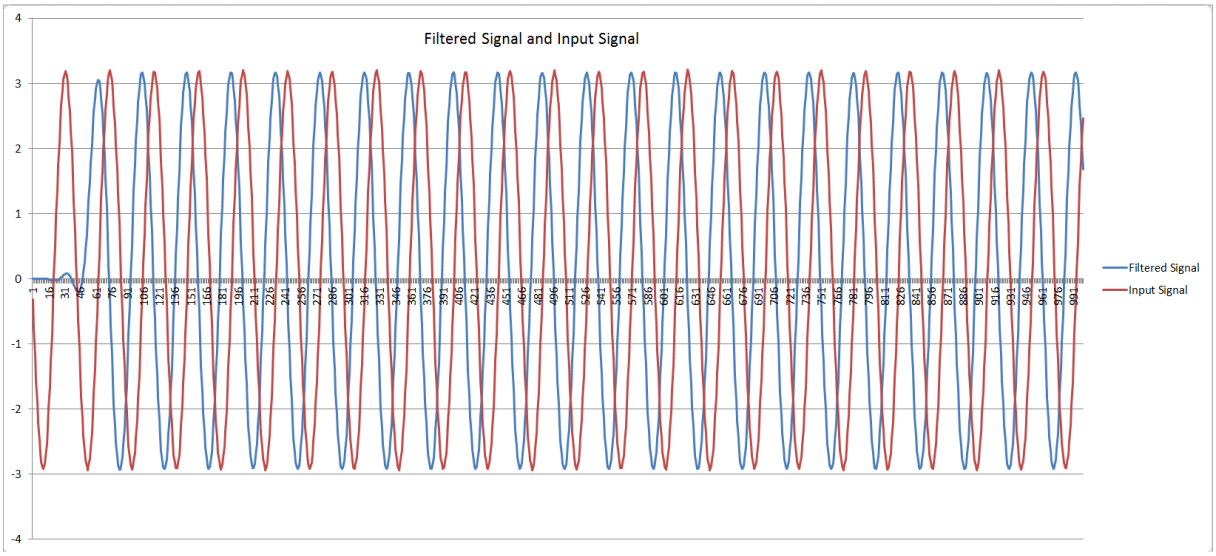
c. Both Signals—this is an overlay of the filtered signal and input/original signal shown above.
**The sampling rate used for these signals was 2000 Hz



d. Computed Statistics

The included file "dataOutput.txt" has a record of the recorded average, variance, maxValue, minValue, and sum of values for the Filtered Signal.
**These computed statistics were found by using the "FIR70Hz.txt" file of coefficients.
**The sampling rate used for these calculations was 2000 Hz

8. Record Keeping

4/28/15: Set up of project and development environment and getting the network communication established. Began setting up the programs control logic.
Duration: 45 minutes

4/30/15: Finished setting up the control logic. We were able to send data from the client program to the server program. Began setting up data acquisition code on the Server.
Duration: 90 minutes

5/5/15: Continuing to work on data acquisition software on the server code. Attempted to write a convolution function, and failed miserably.
Duration: 75 minutes

5/7/15: Succeeded in reading in both of the analog signals from the DT9816, convoluting them with a convolution function, and sending them back to the

client program.
Duration: 135 minutes

5/11/15: Rewrote the convolution function to use a rolling buffer in order to include the last buffer in the current buffer.
Duration: 120 minutes

5/12/15: Finished the control logic. We were not able to get the LED's to properly work in time for the demo. Demonstrated the program to Vikram. Wrote up lab report for submission.
Duration: 335 minutes