the power spectrum of signal. The wiring diagram is as shown in figure 8

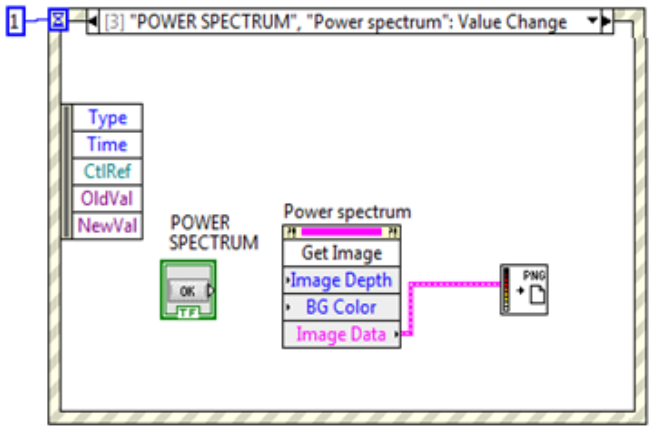


Figure 8: save power spectrum of signal

4. Stop

Stop control stops all programming because it is connected to conditional terminal of while loop. If condition is satisfy then while loop executes. At this case condition of while loop is satisfied thus program stops.

Design of front panel of 4/16 Channel Data Acquisition System

The front of 4/16 channel data acquisition is as shown below. There are four tabs created on front panel. When program start running, counting starts. It continued until user select new tab otherwise user can stop the program. The first tab of START PROGRAM is as shown in figure 9.

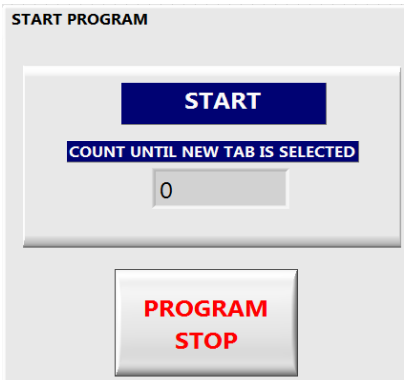


Figure 9: START program

Second tab on front panel is ACQUIRE SIGNAL AND PROCESSING. This tab has two sub-tabs.in first tab signal is acquired. Two types of signals namely 4/16 channel input and simulated signal that to be selected first and according to type of signal, select their parameters as shown in figure 10

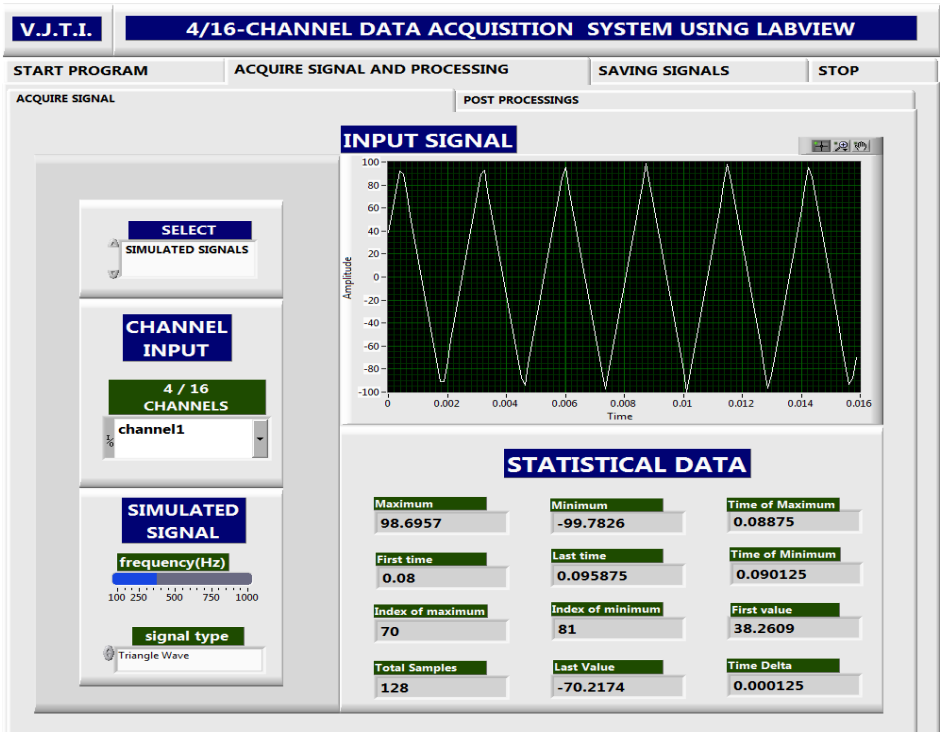


Figure 10: ACQUIRE SIGNAL

The second sub-tab of ACQUIRE SIGNAL AND PROCESSING is post processing. Here set the filter parameters, the digital IIR filtered signal, FFT of signal and power spectrum signal are displayed on graph indicator. The post processing tab is as shown in figure 11

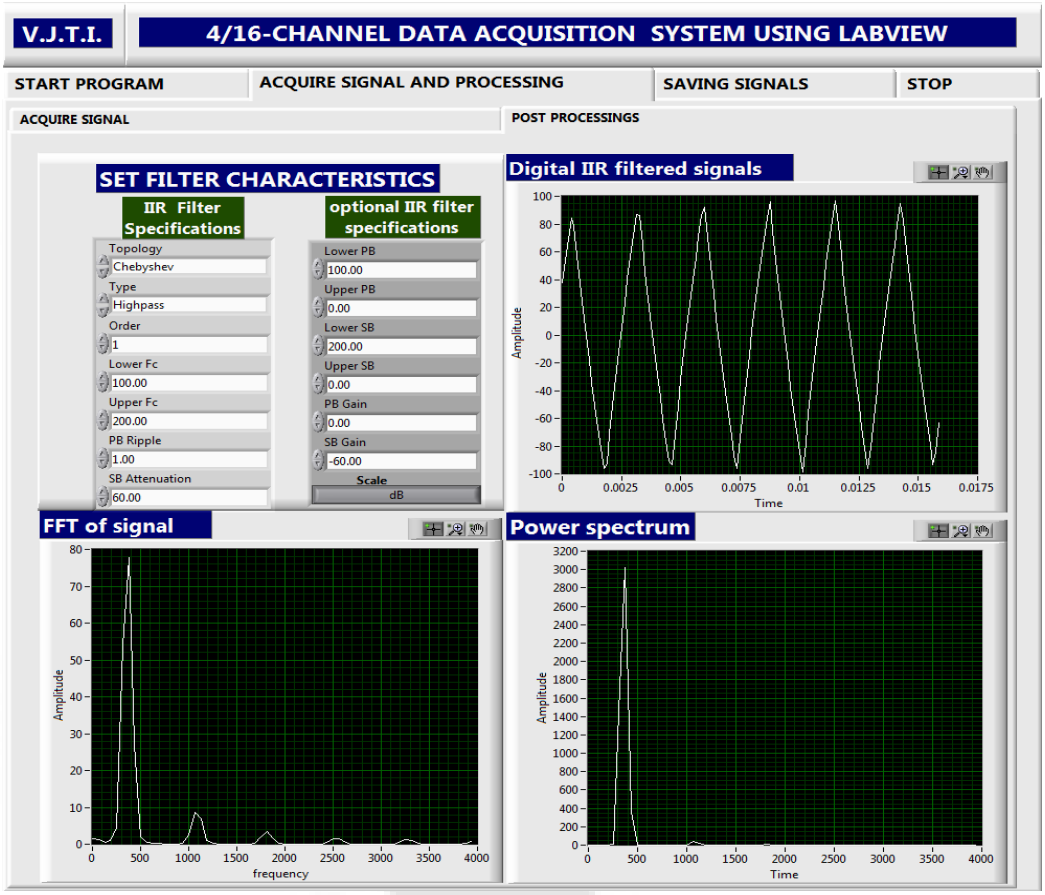


Figure 11: Post Processing

Third tab on front panel is saving signals. Press the save buttons of signals that to be saved. one window is appearing. Give destination path to save the image. The image is saved in .png format. The saving signal tab is as shown in figure 12

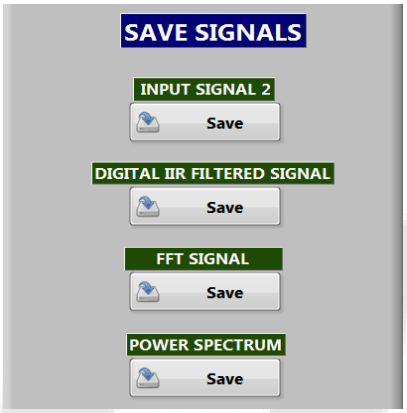


Figure 12: Saving Signal

Last tab on front panel is STOP. Here the condition of while loop is satisfied so program stops whole execution. The stop tab has stop button as follows is as shown in figure 13

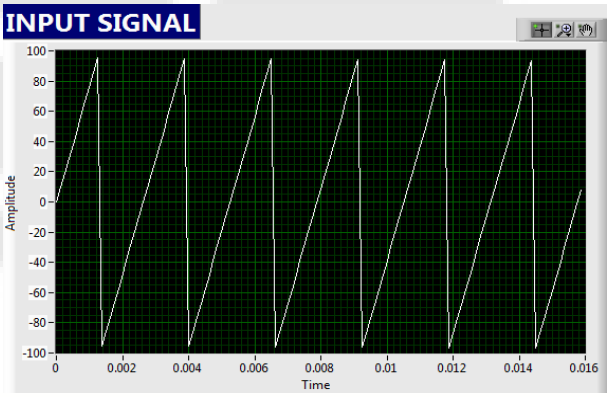
Figure 13: stop everything

5. Results and Discussion

The 4/16 channel data acquisition system using LabVIEW software is divided as first it acquire signals from user or system and then it filtered it and measure the frequency content of and convert the results to real-world units and displayed it using LabVIEW software.

1. Acquire Input signal

First signal is acquired by selecting channel input or function generator signal input which is also called simulated signal.



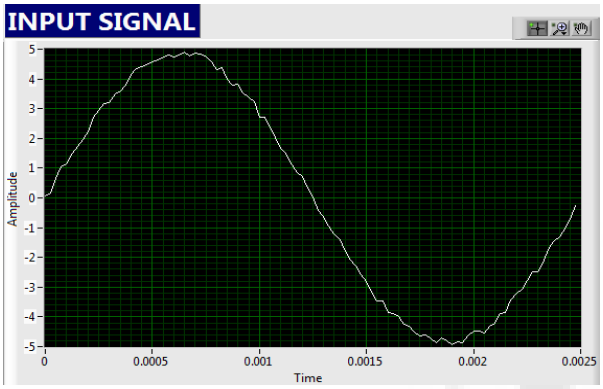


Figure 14: simulated signal and 4/16 channel input signal

Statistics block used in designing returns the selected parameter of the input voltage signal in a waveform as shown in figure 15.

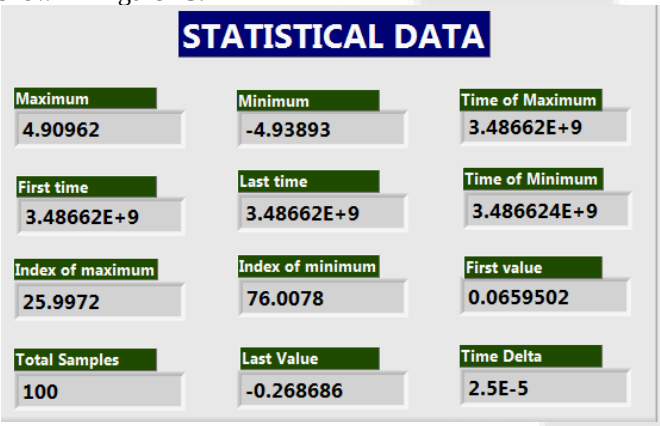


Figure 15: Statistical analyzed data

The parameters of input voltage signal which can be measured are as follows

Total samples: Returns the total no. of samples in signal.
Index of Max.: Returns the index value of the highest value of the highest pt. of the values in signal.
Index of Min.: Returns the index value of the lowest pt. of the values in signal.
Last value: Returns the last value in signal.
First value: Returns the first value in signal.
Time of Min.: Returns the time of the lowest pt. of values in signal.
Minimum: Returns the lowest pt. in a set of values in signal.
Time of Max.: Returns the time of the highest pt. of values in signal.
Maximum: Returns the highest pt. in a set of values in signal.
First time: Returns the first time value in signal.
Last time: Returns the last time value in signal

2. Filtering of signal

In this project filtering of signal is performed first by using digital IIR Filter. The function of a digital IIR filter is to remove unwanted parts of the signal, such as random noise, or to extract useful parts of the signal, such as the components lying within a certain frequency range. Due to filtering some amount of amplitude is decreases. The system can set filter parameters to get better filtering signal as shown in figure 16

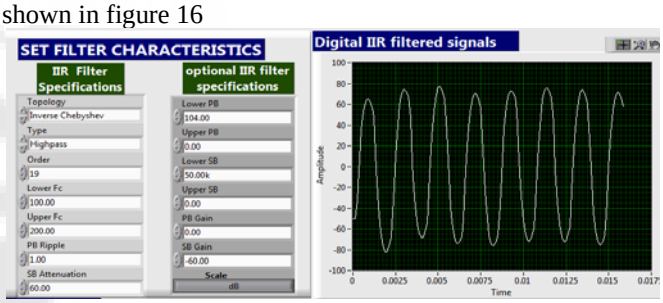


Figure 16: digital IIR filtered signal output

3. FFT and power spectrum of signal

LabVIEW comes with built in FFTs that make the process of component separation quick and easy. So spectral measurement block is used to show FFT based magnitude spectrum. FFTs produce the average frequency content of a signal over the entire time that the signal was acquired. Power spectrum which shows energy spreading into frequencies those were not present in original signal. The FFT and power spectrum is as shown in figure 17

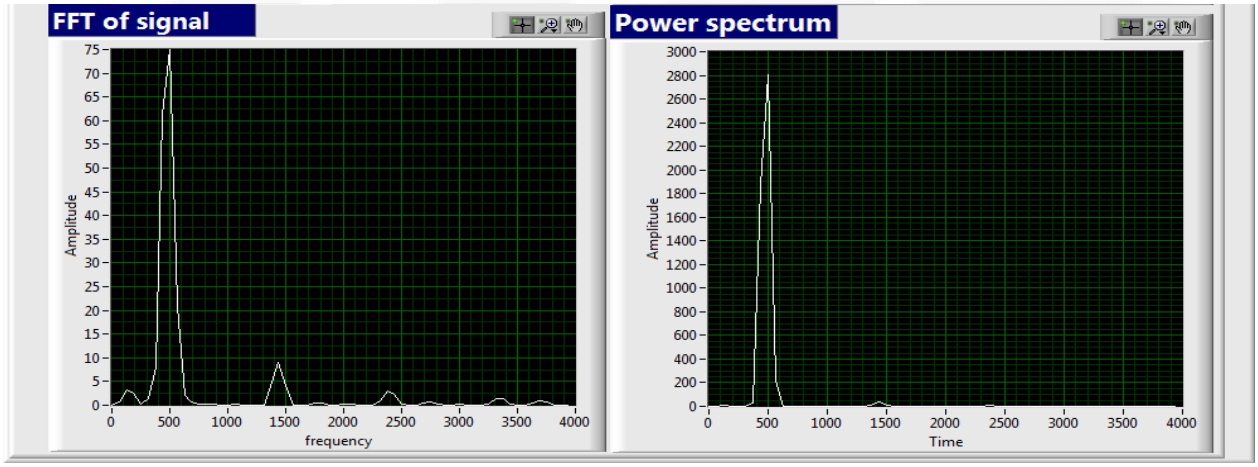


Figure 17: FFT and Power spectrum

All the results are displayed on graphical user interface based program of 4/16 channel data acquisition system which work upon received data and process it effectively for optimum requirement of industry.

6. Conclusion and Future Scope

The 4/16 channel data acquisition System is basically enwrapped with PC based data acquisition. Here data is acquired in the form of electrical pulses of some micro volts range, filter them, amplify them and finally fed it to PC where a GUI based Program can work upon the received data and process it.

For developing 4/16 channel data acquisition system it is essential to meet the requirements are Configuration of the analog input, Actual reading of the analog input as per the parameters mentioned above, Displaying the waveforms/data acquired, Displaying the various data inferred from the acquired input, Post-acquisition analysis, Saving a data, Retrieving the data from a saved file for regeneration and analysis.

Here conclusion is that software developed acquires data from four and sixteen channel data acquisition system and requisite processing on the data can be done during functioning of software. Processing like pre-filtering using digital IIR filtering, FFT and Power spectrum etc. were visualized on front panel. As discussed in results FFTs produce the average frequency content of a signal over the entire time that the signal was acquired. The power spectrum shows power as the mean squared amplitude at each frequency line but includes no phase information. Because the power spectrum loses phase information, use the FFT to view both the frequency and the phase information of a signal. The power spectrum and FFT of signal are closely related to each other.FFT (amplitude spectrum) of signal is nothing but square root of power spectrum.

The data acquisition system developed has certain limitations in terms of accuracy and features like frequency and resolution. The system designed using LabVIEW has many advantages over system designed over MATLAB but it is the cost which has restricted LabVIEW to only large scale applications. Developed 4/16 channel data acquisition system is LabVIEW independent since it builds executable file in LabVIEW which can run in another computer without using LabVIEW software. Also this software can be employed for more no. of channels using recent and more advance DAQ devices. The four/sixteen channel data acquisition system is mainly designed to acquire acoustic emission signals. The acoustic emission system are capable of using multiple sensors/channels during testing, allowing them to record a hit from a single Acoustic emission event. This event can be detected on several channels. Through the analysis and processing of acquired AE signal, any defects inside the material can be detected.

References

[1] Hans-Petter Halvorsen, 'Data Acquisition in LabVIEW, Department of Electrical Engineering, Information Technology and Cybernetics, 2013.08.16
[2] Patterson Casmir D'Mello, Sandra D'Souza, Design and development of a Virtual Instrument for Bio-signal Acquisition and Processing using LabVIEW International Journal of Advanced Research in Electrical, Electronics and Instrumentation EngineeringVol. 1, Issue 1, July 2012
[3] HogskoienTelemark," *LabVIEW programming examples .pdf*", Telemark university Department of Electrical Engineering, Information Technology and Cybernetics.
[4] Jeffery Travis, Jim Kring "*LabVIEW for Everyone-Graphical Programming Made Easy and Fun*" 3rd Edition, prantice hall publication
[5] National Instruments,"NI-6115_6120 user manual", national instrument corporation, November 2002 edition.
[6] National instruments, "installation guide BNC 2110", National Instrument Corporation
[7] Michael Cerna and Audrey F. Harvey," The Fundamentals of FFT-Based Signal Analysis
[8] And Measurement" Application Note 041
[9] Dr. Peter Avitabile," Basics of Spectrum Analysis/Measurements and the FFT Analyzer", Mechanical Engineering - 22.403 ME Lab II, University of Massachusetts Lowell
[10] KishoriJadhav," comparative study of four channel data acquisition system using LabVIEW", international journal of engineering research and technology, volume 3,issue 5,may 2014
[11] https://decibel.ni.com/content/docs/DOC-3522
[12] http://www.ni.com/white-paper/3331/en/
[13] http://www.ni.com/LabVIEW 2012
[14] http://www.ni.com/NI-DAQmx 9.8