GUI Based 6-Band Audio Equalizer

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BACHELOR OF COMPUTER ENGINEERING

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Project Report

Submitted To:

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Complex Engineering Problem

➢ Problem Statement:

Design a GUI based 6-band Audio Equalizer in MATLAB which has sliders for:

- Frequencies less than 200 Hz
- Frequencies between 200 Hz-1 kHz
- Frequencies between 1 kHz and -2 kHz
- Frequencies between 2 kHz-3 kHz
- Frequencies between 3 kHz-4 kHz
- Frequencies greater than 4 kHz

This equalizer must be able to:

- Browse audio files available on the system and plot the audio signal with respect to time.
- Play, pause, and stop the selected audio file.
- Plot the single-sided frequency spectrum of the audio signal.
- Adjust the gain of each frequency band and display the impact of this adjustment on the input signal. For instance, if the gain for the frequencies less than 200 Hz is increased by using the slider, the frequency spectrum plot should show this increase in gain.
- Play the new audio file with the desired adjustments and plot this signal with respect to time.

➢ EQUALIZER:

An equalizer is an audio engineering tool that equalizes or compensates for different frequency components of an audio signal. They can be used to cut or boost the levels of specific frequency ranges, thus changing the quality of the audio signal. Equalizers use various filters and allow you to adjust, or gain, the frequency ranges of the audio signals. Several types of equalizers exist, but the most common and well-recognized equalizer is the graphic equalizer. Most graphic equalizers divide sound between 3 and 31 bands of frequency, with a physical or virtual slider controlling the volume of each band. The increase in the number of bands provides better control in adjusting the frequency components of the audio signal. For example, a simple 3-band equalizer may have **bass**, **mid**, and **treble** sliders. A 7-band equalizer may have sliders for specific frequencies, such as 50 Hz, 120 Hz, 300 Hz, 800 Hz, 2 kHz, 5 kHz, and 12 kHz.

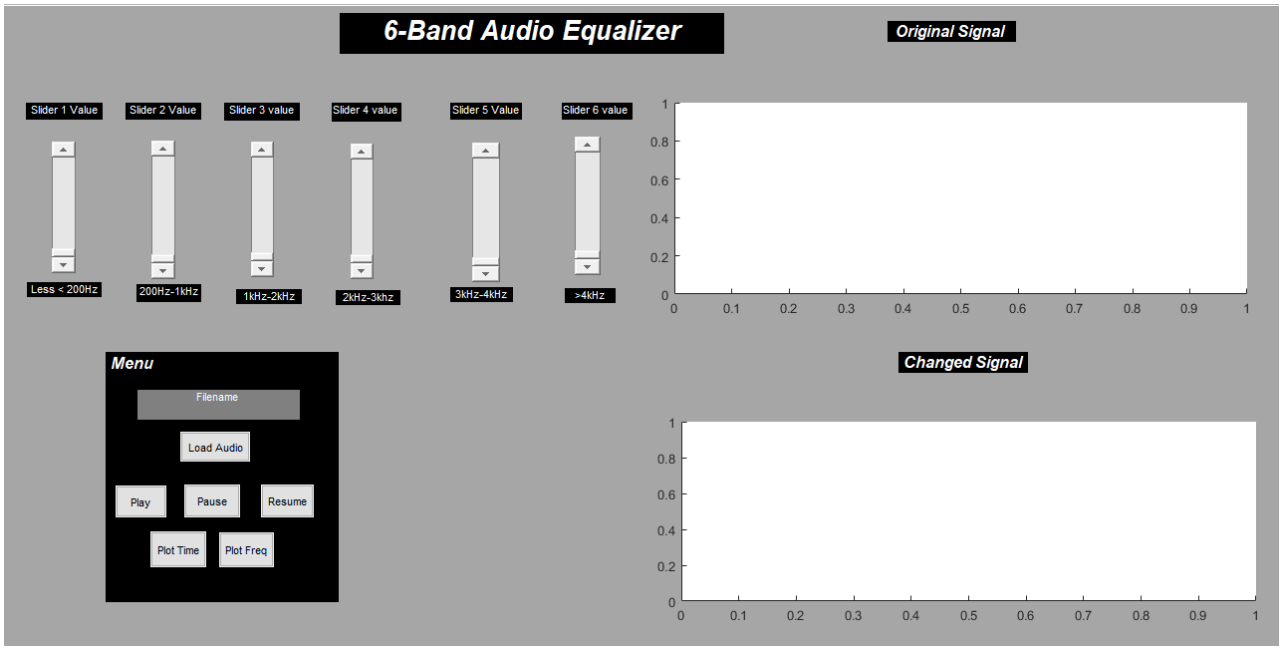
➢ MATLAB GUI:

GUI, also known as graphical user interfaces, provides point-and-click control of software applications, eliminating the need to learn a language or type commands in order to run the application.

➢ INTRODUCTION:

In this project, we have created our own equalizer using MATLAB GUI. This is for the graphically part and for the coding side we have used different types of filters that were designed using the built-in filter designer tool in MATLAB.

➢ OUR DESIGN:

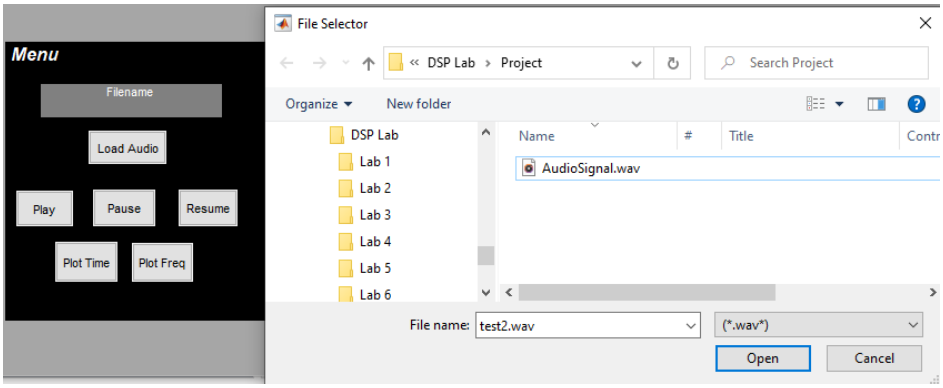


DESCRIPTION:

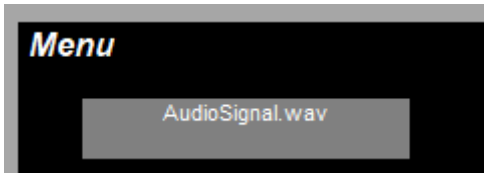
So, we created 6 sliders, a menu box, and two axes named original signal and changed signal. The menu box will be used to load play, pause resume plot time, and plot frequency graph. axes 1 will only show the graph of the original signal in the time and frequency domain.

➢ LOADING AUDIO:

By clicking the load audio push button, you will see a menu box that will let you select your audio in the current directory.



We have only used the format of .wav files so all the .wav files can be loaded and seen on the dialog box. Once the audio has been loaded its name would be displayed like this in the display box.

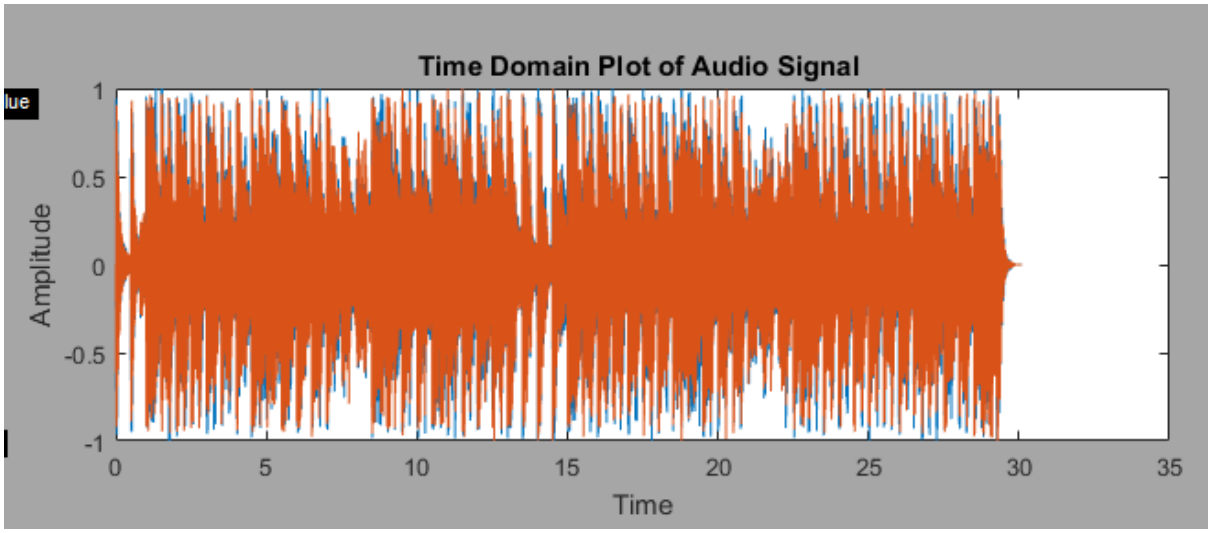


➢ PLOTTING GRAPHS:

For our audio that has been loaded, we need to plot the time and frequency graph of that audio signal. For that purpose, we have two buttons:

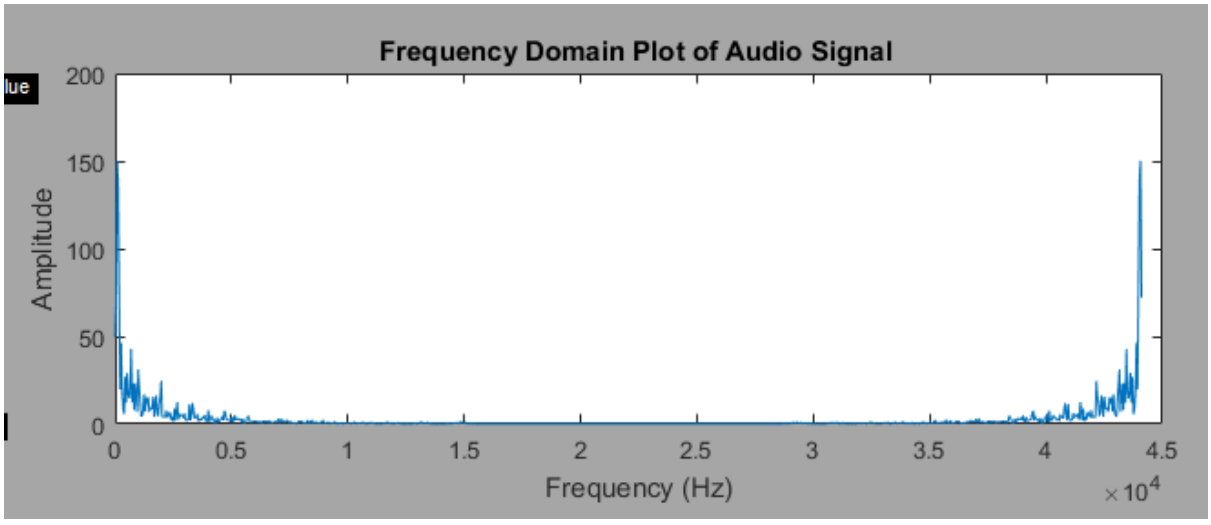
Pressing these buttons will give you plots of time and frequency one by one on the axes 1.

TIME:



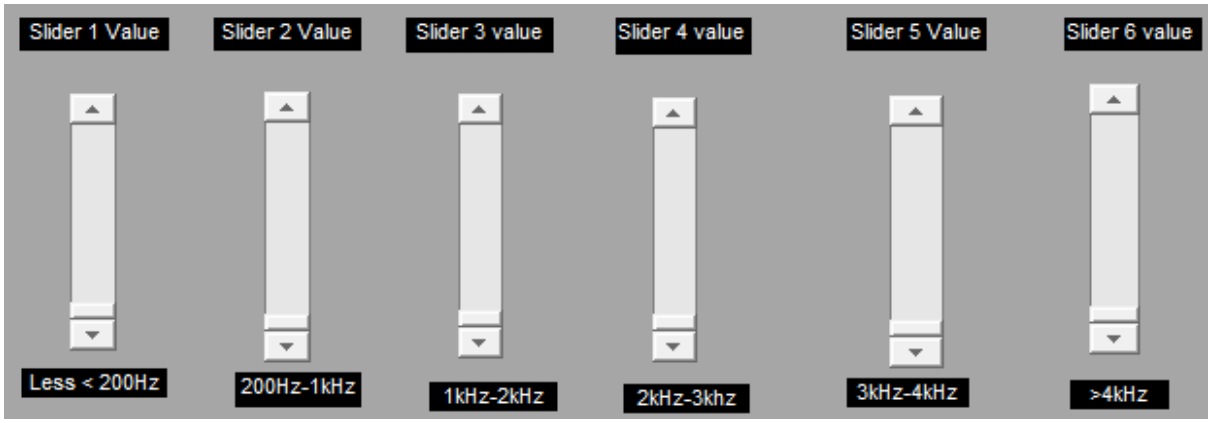
The time graph shows us the total time in seconds of the signal with its amplitude. Our signal that we used was 30sec long so we can see that in the graph as well.

FREQUENCY:



By pressing the plot freq button we get the frequency plot. Our signal sampling frequency was 44100 and we can see that in the graph as well.

➢ SLIDERS:

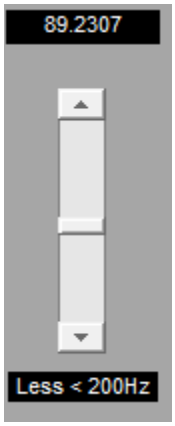


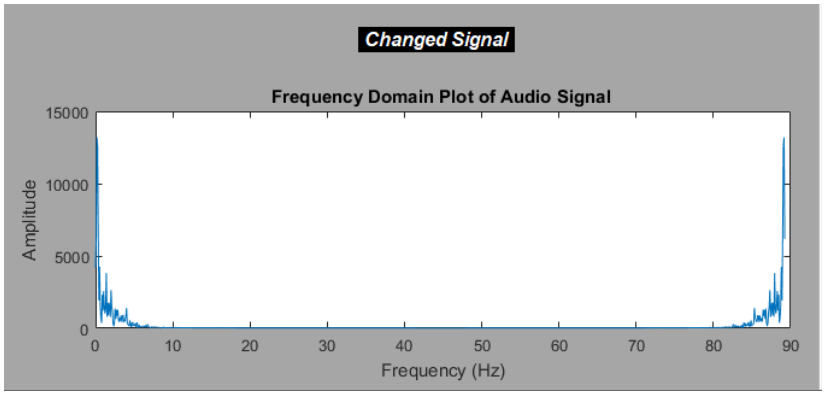
All these six sliders have different functions. Slider 1 has been applied using a low pass filter. The sliders 2 to 5 are of bandpass and the last one is of high pass filter. All the sliders have been preset so that they will not exceed or downgrade their value other than the values mentioned below them.

These sliders will not only change the frequency values but also produce graphs of what range they are working at. They will be shown in axes 2 under the changes signal.

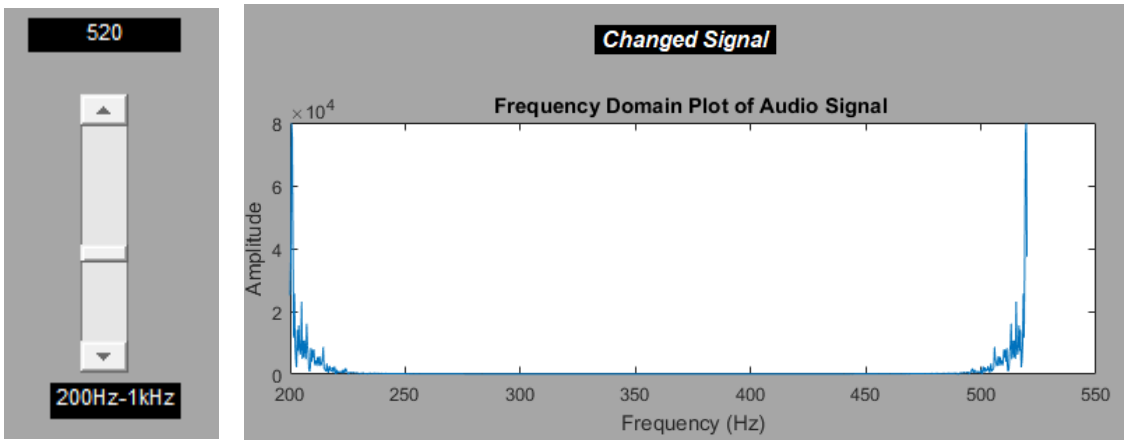
GRAPHS:

For sliders 1 (range <= 200 Hz):

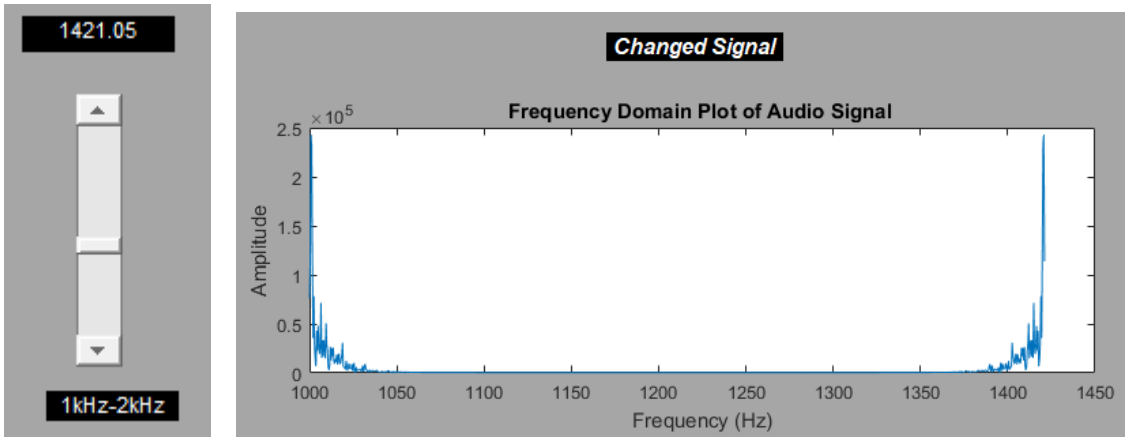




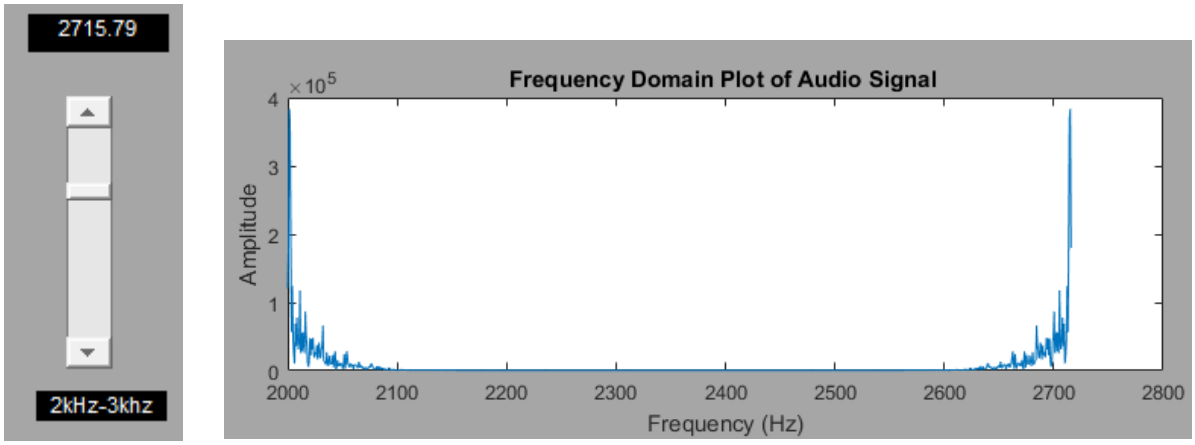
For sliders 2 (200Hz <= range <= 1000 Hz):



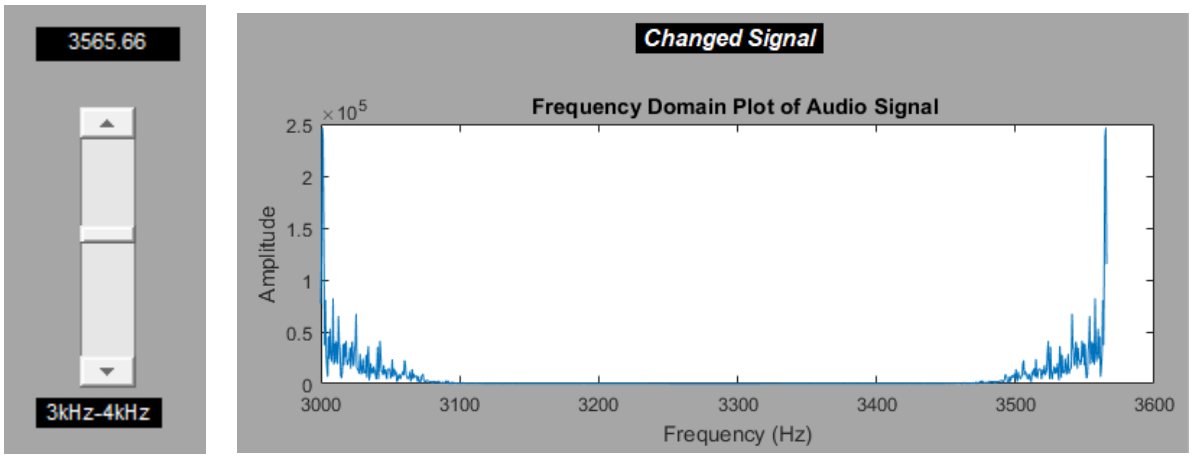
For sliders 3 (1000Hz<= range <= 2000Hz):



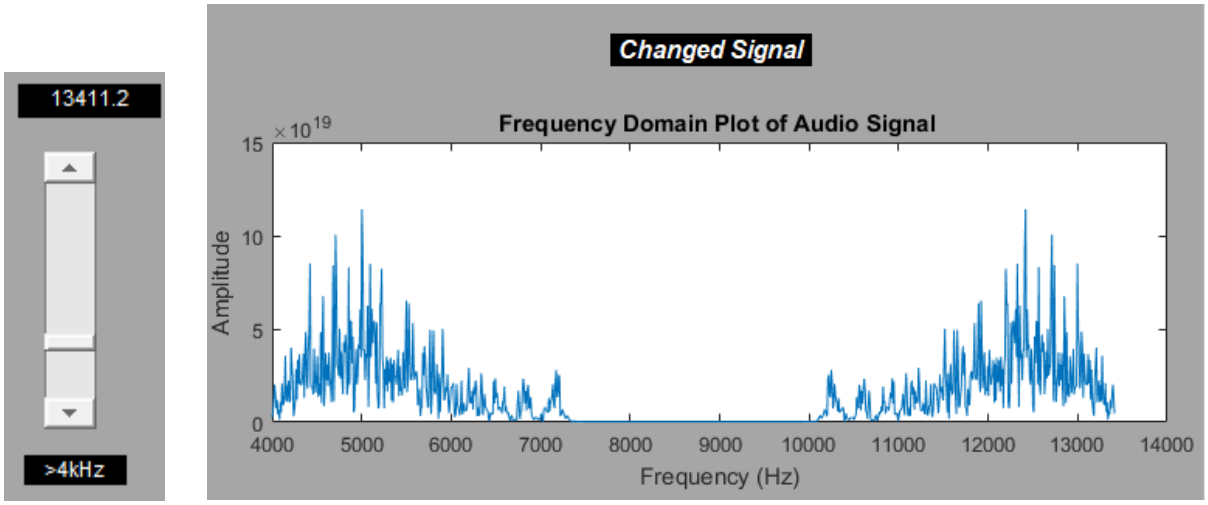
For sliders 4 (2000Hz<= range <= 3000Hz):



For sliders 5 (3000Hz<= range <= 4000Hz):



For sliders 6 (range > 4000Hz):



➢ CONCLUSION:

So, in this project, we worked on audio signals and perform changes on audio signals using different filters which have many applications in studios, radio studios production control rooms, instruments amplifiers, and much more. This is not a professional-grade equalizer but it just gives a hint of what an actual will perform.