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**Signals Bonus Project**

**1. Task**

The purpose of this project is to determine the dominant spectral component of a signal. This is done in in 1 second windows with a 50% overlap. The power is also to be calculated. All of this data is to be written to a CSV file that has the appropriate column headers.

**2. Solution**

The program can be compiled with the following command:

g++ main.cpp -o a.out

Much of the code that I used was taken from the first part of the project. The WAV header struct was used as well as the code to read in the WAV file. The first major step is to implement a Fourier series function. To do this I simply implemented the fast Fourier series algorithm that can be found with a simple google search.

The ffs function takes a CArray as input. This array will contain the entire wave file. In the main function I calculated the exact length of my WAV file as well the total number of samples. The sampling frequency is also given in the WAV header. With this data I can calculate the index at certain intervals. For example, If I want the index at 0.5 seconds, I would multiply 0.5 times the sampling frequency. This gives me what index occurs at 0.5 seconds.

To get the 50% window overlap used for loop to go in 0.5 second intervals. For example, if I start at 0 seconds, I would be start at index 0 and go I seconds. The index at 1 second would be 44100. Next, I would do the same thing but starting at 0.5 seconds and going to 1.5 seconds.

Each of these increments are loaded into a mini buffer. From there the fft() function is used to take the Fourier transform. After that, I iterate through the mini buffer to find the maximum spectrum as well as find the power.

The output of the program is written to a CSV file. There is a summary file generated as well. It contains the execution time.

The summary file is below.

Total Process Time: 2898 milliseconds

The program is running in real time with the audio file that I have suppled. All other information can be found in the auto generated CSV file.

**3. Conclusion**

Overall, this project was very interesting. Working with data in the frequency domain is a very new thing to me. I wish we had more time to fine tune our solution.