Revolution Per Minute (RPM) Calculation of a flying aeroplane

Methodology:
1. Audio extraction: We have extracted an audio from the video first, the reason of doing that step is that spectral analysis of an audio signal is easier and very effective. Secondly the audio was a stereo type meaning that it has two channels, so we convert it to mono-channel for easy pre-processing.

2. Denoising: There was two types of noise which were detected, the first one was the background noise below than 1000Hz, the second one was human having frequency range of almost 7580 Hz (estimated after applying a bandpass filter).
Filter specification: (Band-Pass Filter)

Lower pass band: 1000 Hz

Upper pass band: 8500 Hz
Filter type: 4rth order Butter worth

3. Time and Frequency domain analysis: we have used both frequency and time domain analysis at the same time to identify the frequency spikes accurately. We have used hamming windows (128, 256) which were best in this case because we were able to locate the exact location of the frequency spiks.

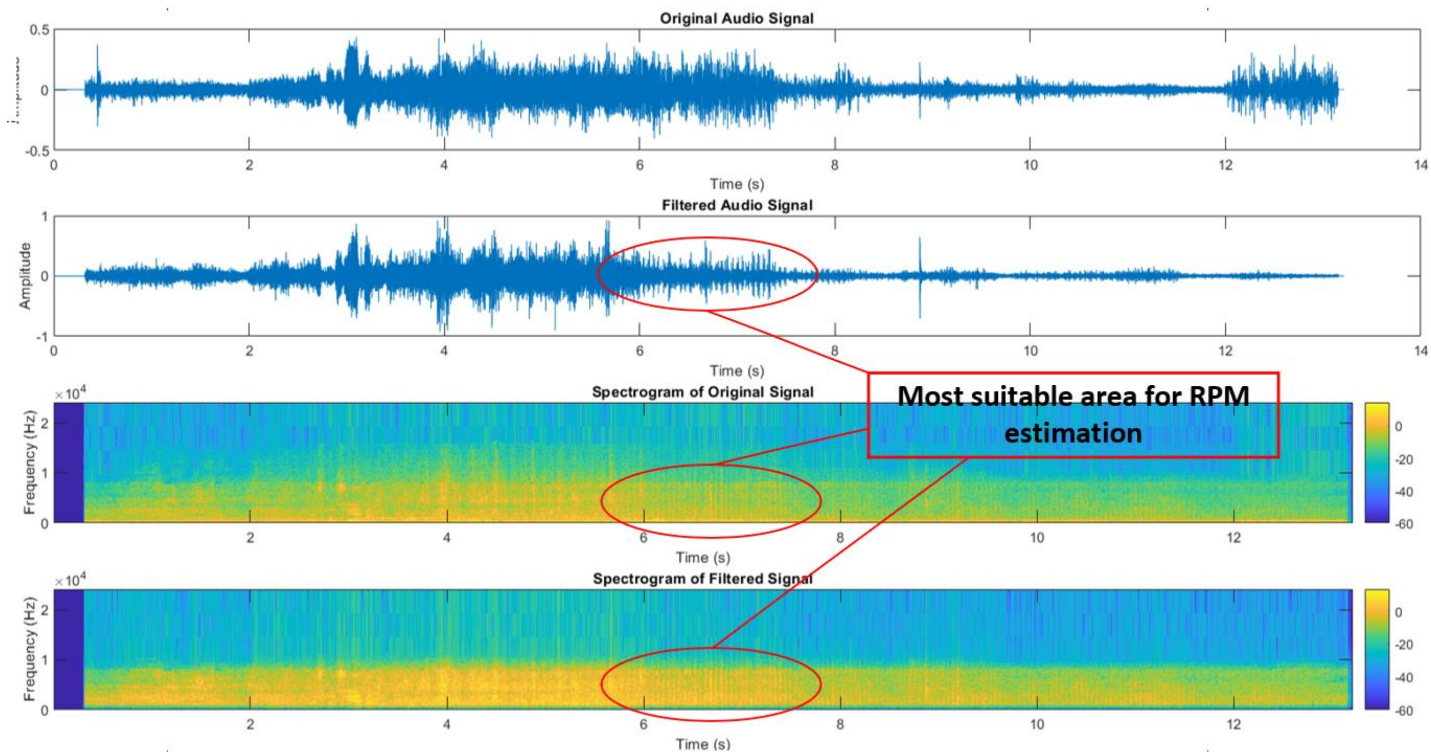

Figure.1.1 Area of interest

There are multiple approaches of RPM estimation once we locate the frequency spikes, however, it becomes quite easier to count manually once we locate exact location, we can do it using MATLAB *max()* command, however in the presence of irregular noise, this approaches is not that much effective. So, we manually calculated the frequency spikes.

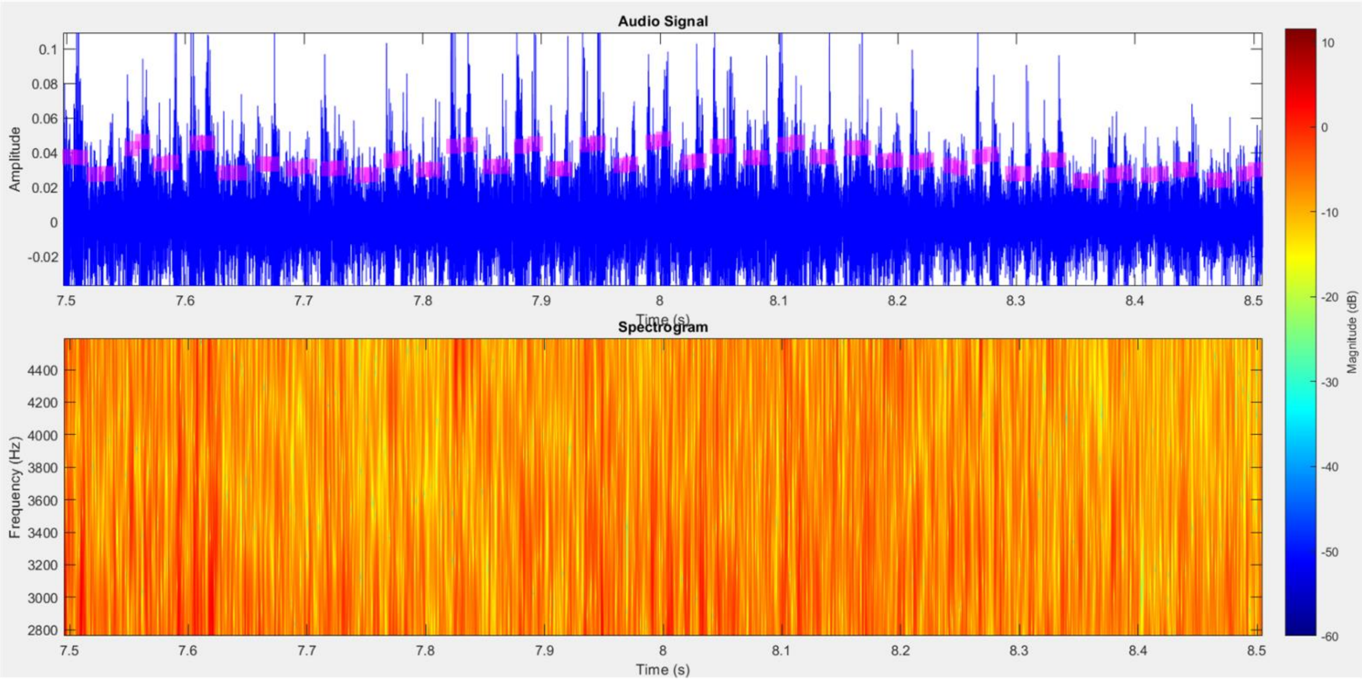

Figure.1.2 Paired correlating frequency spikes

Conclusion:

Spikes located using spectral analysis: (S) 37 spikes in one second.

RPM= S*60
RPM= 37*60

Result: 2220 RPM

Verification: The above result indicates that the engine used in the aeroplane was Cessna which has RPM value of 2200, so the above result is very near to the exact value. The uncertainty is due to the presence of noise.

Accuracy: 99.1%