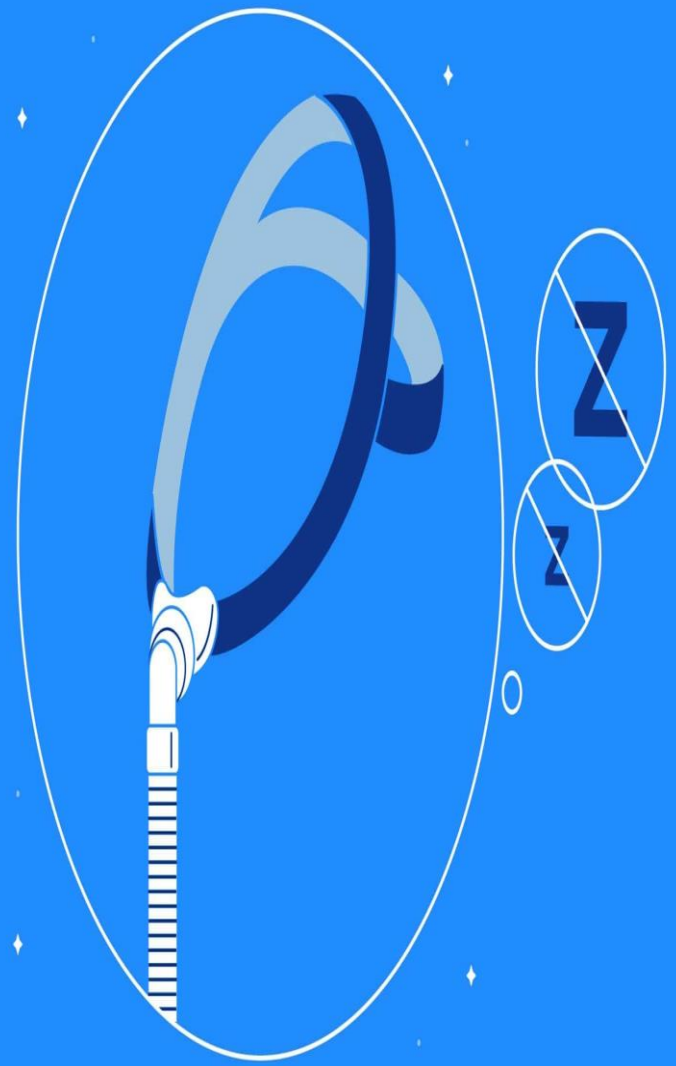
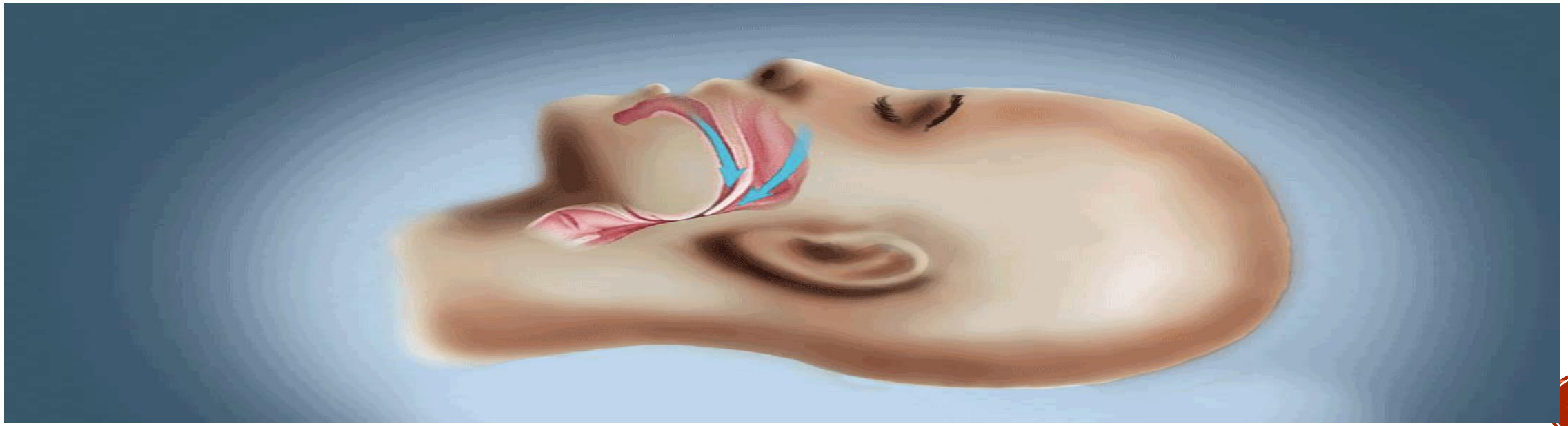


SLEEP APNEA DETECTION

WHAT IS SLEEP APNEA AND IDEA BEHIND THE PROJECT?

Sleep apnea is a common disorder that causes your breathing to stop or get very shallow. Breathing pauses can last from a few seconds to minutes. They may occur 30 times or more an hour.

Sleep apnea is a serious breathing disorder with more than one million cases being reported in a year in India.

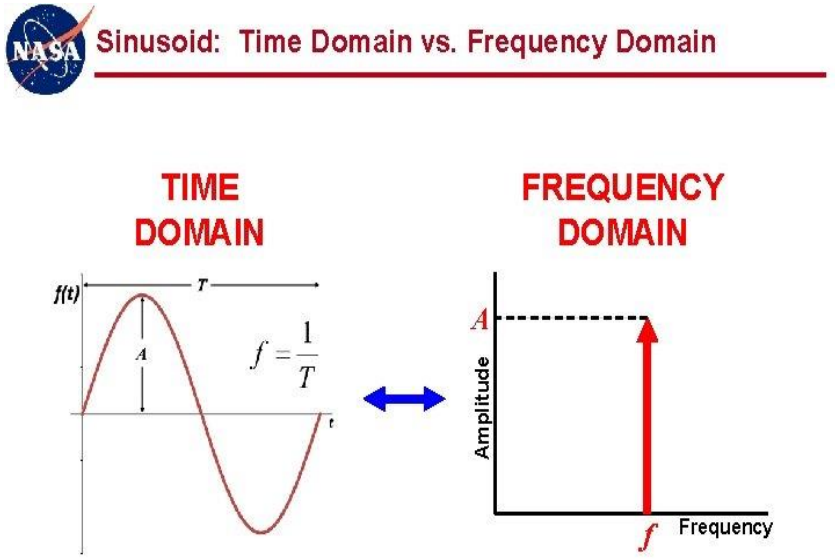


IMPLEMENTATION / APPROACH

- We have a dataset of 10 audio files of approximately same time duration in which 5 are of apneatic patients and 5 are of non-apneatic patients. to perform operations on the input, MATLAB is used as the software.
- Using MATLAB the two important task that are done are-

1) Plotting the audio signal in the time domain.
2) Plotting the signal in the frequency domain.

This is done for the entire dataset and then by comparison we are able to obtain certain threshold values and if for a Person the value is more than the threshold value, chances of apnea increases

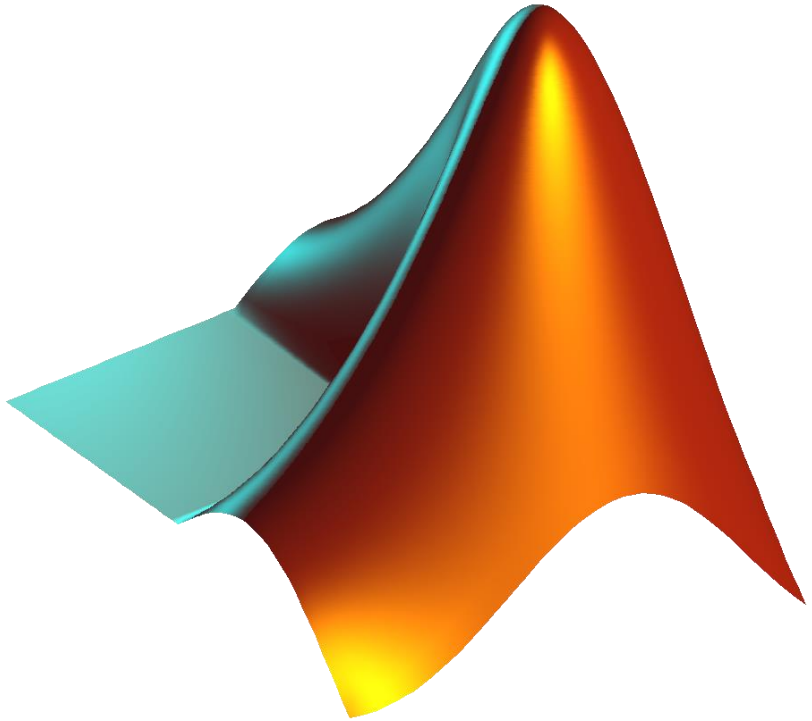


IMPLEMENTATION / APPROACH

- One of the most common symptom of sleep apnea is snoring and irregular breathing, by observing the time domain we can see the nature of breaths which in a normal person has to be regular where the peaks also have values equal to each other.
- Whereas for an apneatic person, the pattern should come out to be irregular with the peaks having very large values as compared to normal/standard values.
- Snoring is considered to be normal only below the frequency of 500 Hz, using frequency domain, we will be able to observe the variation in frequency for an input.

CODE

Time domain analysis-:



```
[x,fs]=audioread("name_of_the_audio_file.wav")

//this line basically converts the audio input in wav format into a set of
datapoints in a matrix, where each element contains the amplitude at certain
point of time and this matrix is stored in x whereas the fs calculates the
sampling frequency and for this project, sampling frequency for every data is
4800 Hz.
```

```
x=x(:,1);

//x here becomes the length of one entire column
```

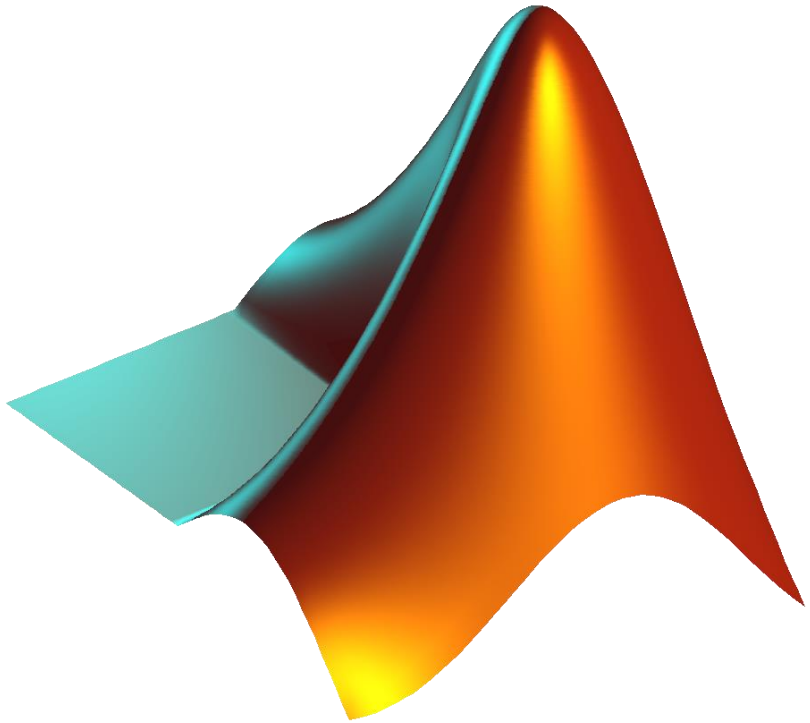
```
N=length(x);
t=(0:N-1)/fs;

//by dividing the length of the entire column with the sampling frequency we
obtain the time of the audio input
```

```
%plot time domain signal
plot(t,x)
grid on
xlabel('time(s)')
ylabel('ampl')
title('signal in time domain')
```

```
%stats information
maxValue=max(x)
minValue=min(x)
meanValue=mean(x)
stdValue=std(x)

//this calculates various statistical information like  maxima, minima, mean
and standard deviation.
```

CODE

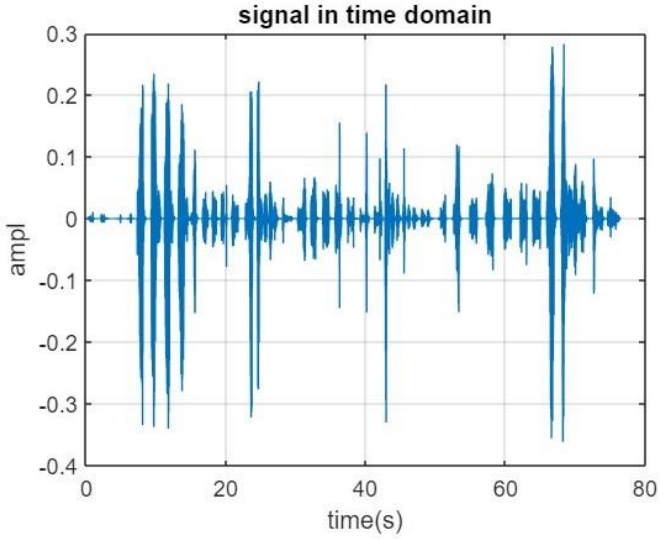
Frequency domain analysis-:



```
[y,fs]=audioread("sample_audio.wav");

%frequency domain
nfft=length(y);
//this basically tells us the length of the signal we want to calculate the
fourier transform of
f=linspace(0,fs,nfft);
Y=abs(fft(y,nfft));



figure;
plot(f(1:nfft/2),Y(1:nfft/2));
title('freq domain')
xlabel('freq')
ylabel('abs')
```

OUTPUT

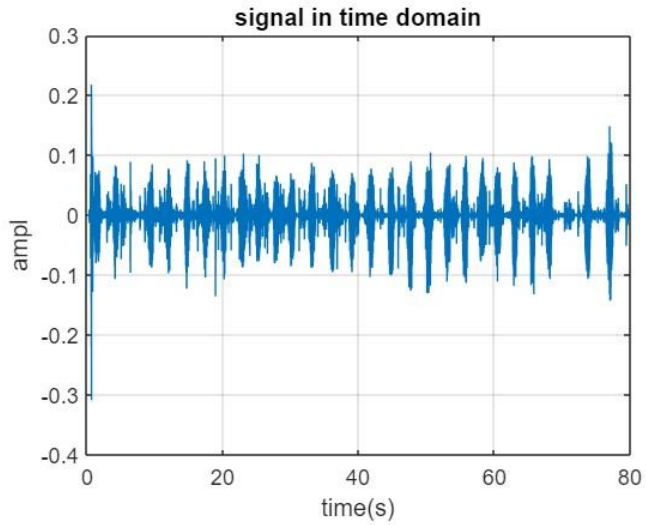
Time domain plot for an apneatic person




```
maxValue = 0.2831
minValue = -0.3614
meanValue = -1.5051e-04
stdValue = 0.0203
```

Time domain plot for a non-apneatic patient

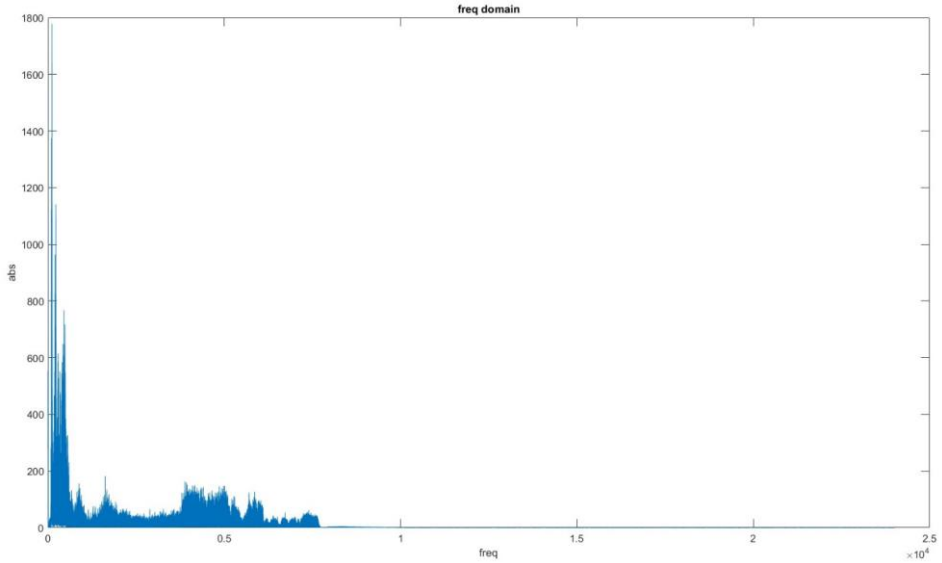
```
fs = 48000
```



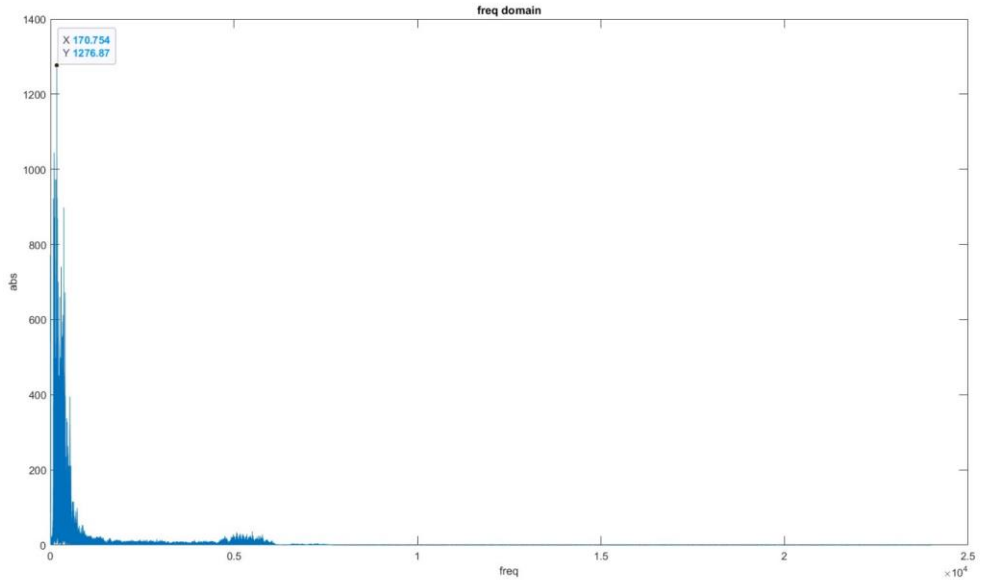

```
maxValue = 0.2177
minValue = -0.3087
meanValue = -2.0138e-04
stdValue = 0.0149
```

OUTPUT

Frequency domain plot for an apneatic person



Frequency daomin plot for a non-apneatic person



CONCLUSION

From the time domain analysis we can clearly see, the difference in the breathing pattern of an apneatic person and that of a non-apneatic person.

From the frequency domain, we can see that how in a normal person the energy is largely concentrated below the region of 500 Hz whereas in the case of an apneatic person, the energy is also shared in the region of 400 Hz to 1000 Hz. Therefore, the threshold frequency of snoring can be considered to be 500 Hz, above which if there is a distribution of energy, the chances of apnea increases for that particular person.

SCOPE/LIMITATIONS

- In Future we can use the current model and modify using Machine learning and Neural Network to directly Identify the Sleep Apnea.
- We can make our model more perfect and accurate using more Dataset in the future
- We can also modify our Model to detect other breathing related disease like Asthma , Chronic bronchitis and **Cystic fibrosis.**
- **We can also use the Given model to detect small Problems related to Heart.**

THANK YOU