# DSP Project Report: ECG Signal Analysis

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## 1 Introduction

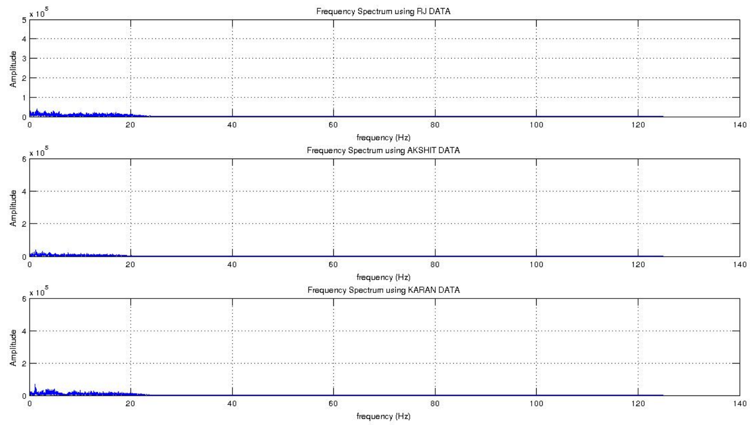
Electrocardiogram (ECG) is a nearly periodic signal that reflects the activity of the heart. A lot of information on the normal and pathological physiology of heart can be obtained from ECG. However, the ECG signals being non-stationary in nature, it is very difficult to visually analyze them. Thus the need is there for computer based methods for ECG signal Analysis.

We were given the ECG data collected using the Wipro AssureHealth device doing various physical activities. The sampling frequency was 250Hz. The data given to us didn't look like an ideal ECG which we generally see in the hospitals. The sources for additional noise could be powerline interference, electrode contact noise , the baseline drift and motion artifacts. There could be EMG from the chest wall. There also could be instrumentation noise.

The purpose of this report is to analyse the data and make a C code such that the output could be given in real-time.

## 2 Data Analysis

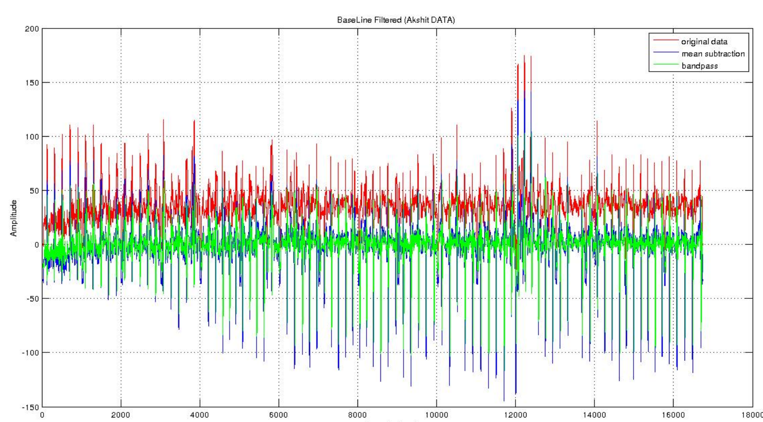
First we analysed the frequency spectrum of the plots given. The signal we received. The frequency in Hertz was only from 0 to 25 Hz, as can be seen from the figure.




The raw data given to us was told to be baseline filtered signal and the cleaned signal is the raw signal passed through a bandpass filter. As seen from the frequency spectrum there is no powerline interference as there is no frequency of 50Hz and multiple of 50Hz. To remove the powerline interference we can use a notch filter to remove 50Hz and it's multiple frequencies, that is, 50Hz and 100Hz.

However, as per the plot, the signal was not baseline corrected. After subtracting the signal from it's amplitude mean, we get baseline corrected signal. This gives us a similar plot as passing the signal from a bandpass filter, allowing the frequency between 10Hz and 20Hz.

The plot here plots the original signal in red, the mean subtraction data is in blue and the bandpass filter data is in green.



For the R-peak detection, after filtering we double differentiated the data, the basic purpose of which was to amplify the noise. Here the noise in our case can be thought of as the R-peak. So if there is any peak, it will amplify those. When subtracting 2 points nearby; if they are close to each other, the points will suppress, and if they are apart from each-other they will get amplified. After that we took an optimal window size of 175 samples (found after exploratory analysis), and found the peaks in the data.

The original data can be seen and double differentiated data also can be seen from the plot to clearly see the peaks.