Innovative Algorithm For Detection And Analysis of P-Wave

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Abstract- *This paper relates that, we have been delved invention of the P wave i. e. A new method to ameliorate the recording of atrial activities of patient heart. The electrocardiogram feeds normal & abnormal recording activities due to this electrical signals generated during the cardiac cycle, and measured with the help of these 12 electrodes. It has medical importance in recording of heart's activity is well promoted & is used for example to appoint heart rate, investigate weird heart rhythms, and different reasons of chest pain.*

This method is developed for detection & analysis of P Wave. Methods:- Electrocardiogram signal is generated by using different database available on physionet.com website. Preprocessing has done on this Electrocardiogram signal for filtering the noise from given input signal by using low pass filter, high pass filter and band pass filter. Then after that QRS detection have done using thresholding for detecting the P-wave.

Keywords- Depolarization , P wave, Preprocessing, QRS detection ,Thresholding.

I. INTRODUCTION

In this paper, we have studied finding the elusive P-wave i. e. A new ECG lead to improve atrial activity recordings in our heart[1]. Because we wanted to find out innovative algorithm for the detection and analysis of P wave, by using optimal bipolar lead selection method. The electrocardiogram provides a medico with the overall result of the heart's activity through the electrical signals induced during the cardiac cycle, and measured with external 12 electrodes[1]. It has medical importance in cardiology is well promoted, being used for example to decide heart rate, investigate abnormal or extraordinary heart rhythms, and no of reasons of chest pain.

The Electrocardiogram has a lot of an important tool to find out the functional status of the patient's heart. The Electrocardiogram traced graph includes a wave sequence of P- wave, Q- wave, R- wave, S- wave and T wave which is related with the each and every heart beat. The automatic exploration of ECG waves is very important to cardiac infectious diagnosis. For purpose of a medical setting, such as intensive care units i.e. ICU room, it is imperative for automated systems correctly to detect and classify ECG wave components.

The accurate performance of these systems depend on so many important factors and component, which includes the quality of the ECG signal, the applied classification rule, the learning and the dataset which used for testing purpose. The first deflection means fluctuation of the P wave caused due to the depolarization of the atria. The movement of large QRS complex wave is due to the depolarization of the ventricles[13]. In an electrocardiogram signal, this is the miscellaneous with largest amplitude and is easy to find out.

The P wave in the electrocardiogram which point out depolarization of atrial activities, which is comparatively small and results in contraction of atrial activities. Flow of atrial depolarization proceeds sequentially from right towards left, with the right atrium initiated before the left atrium. These right as well as left atrial waveforms, which results the formation of the p wave. This p wave is divided in three parts as first part relates to activation of right atrial , final part relates to activation of left atrial and the middle part is combination of both.

Basically, heart consists of not only upper chamber but also lower chamber, upper chamber is known as ATRIAL and lower chamber is known as VENTRICULAR[13]. P wave is used to detect the activities in upper chamber. There are two atrium i.e. Right atrium and Left atrium. In this process, Contraction and Relaxation of human heart is depends upon P wave. ECG signal starts with P-wave.

The P wave is a very small wave created by the depolarization front so that it moves through the atria. Basically, the right atrium starts to depolarize firstly as compared to left atrium. Hence, the depolarization of these wave initiates in the Sino atrial node as well as in the right atrium and then travels towards the left atrium. This depolarization is carried out through the atria along with conduction track consisting of Bachmann's bundle which

results in continuous waves having uniform shape. Depolarization occurs elsewhere in the atria which results in P waves with a different morphology from normal.

II. METHODOLOGY

In this paper, we have implemented a pre-processing on Electrocardiogram signal which is evaluated by using various filters. Filtering of signals is essential for many applications, including smoothing, sharpening and removing noise. Also thresholding is used for QRS detection.

1. Low pass filter:

Low pass filtering as name suggests removes the high frequency content from the given signal. This process is known as "smoothing". Basically, noise is occored during the analog to digital conversion process. Noise is normally a high frequency signal and low pass filtering eliminates the noise. A signal is smoothed by decreasing the noise from the signals. From this filter can pass only low frequency signals

2. High pass filter:

A high-pass filter is a filter that passes signals with a frequency higher than a certain cut-off frequency and attenuates those signals which are having lower frequency as compared to the cut-off frequency. This high pass filtering process removes the lower frequency components while allowing only the higher frequency components .This filter is very essential, because it passes only those high frequency component of electrocardiogram signal. From high pass filter only high pass frequency signal can pass.

3. Band pass filter:

Band pass filter is a combination of both low pass and high pass filters. In this filter smoothening and sharpening of signal is done. From this filter, low and high frequency signal can pass. The P wave is having very small amplitude wave found out during the depolarization. It moves through the atria. Especially, the right atrium firstly depolarizes as compared to left atrium. Hence, the depolarized wave originates not only in the Sino atrial node but also in the right atrium. Then it travels through the left atrium. The depolarization is carried out through the atria with the conduction track consisting of Bachmann's bundle which results in continuous waves having uniform shape. Depolarization initiating anywhere in the atria which results in P wave with a different morphology.

Peaked P wave recommend right atrial augmentation , but it has very low predictive value . A P wave with increased amplitude shows hypokalaemia. It can also represents enlargement of right atrium. The P wave with decreased amplitude shows hyperkalaemia. Bifid P wave (known as P mitrale) represents abnormality of left atrial. It is important to remember that the P wave represents one by one activation of the right and left atria. it is very common to see notched or biphasic P wave of right and activation of left atrial.

4. Thresholding:

Thresholding operations on samples, which means retaining or discarding data points that does not meet some kind of criterion. The thresholding is used for finding the signal parts where P-peaks are situated. In this algorithm ,the peak detector is not used. Firstly, time indexes of samples are higher than the threshold which are found. Then, the algorithm computes differences between those time indexes. Only samples with time index differences are higher than the minimal physiological heart period are selected as the P-Peaks[13].

III. RESULTS AND DISCUSSIONS

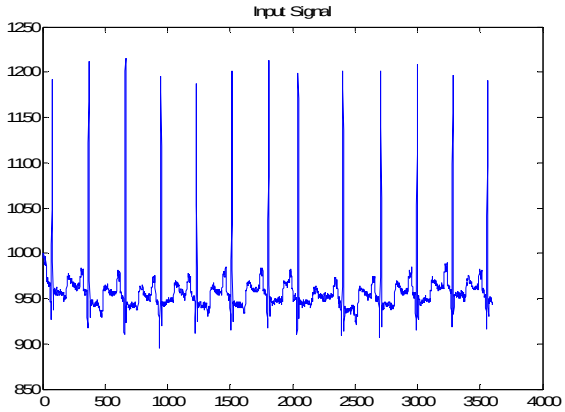

Figure 1. Input signal

Fig. 1 shows the input ECG signal having following specifications:-

Source: record mitdb/100
Val has 1 row (signal) and 3600 columns (samples/signal)
Duration: 0:10
Sampling frequency: 360 Hz
Sampling interval: 0.002777777778 sec

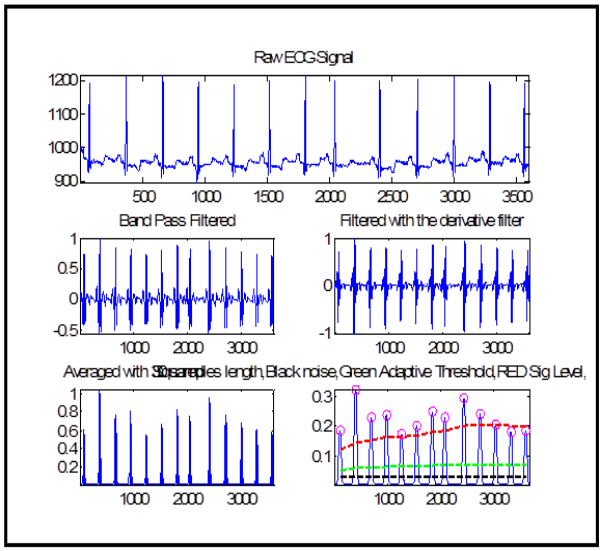

Figure 2. output1

Fig.2. shows ECG signal contaminated with noise. For removing this noise, we have used band pass filter as well as derivative filter. This filtered signal averaged with 30 samples length. In the last graph, Black color shows noise, Green shows adaptive Threshold, Red shows Signal Level and Red circles shows QRS adaptive threshold.

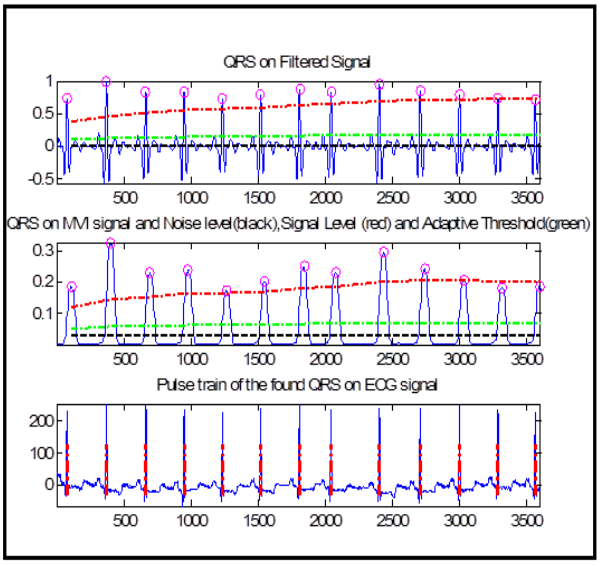

Figure 3. output2

Fig 3. shows the QRS on filtered signal. In this, we found the pulse train of QRS in ECG signal.

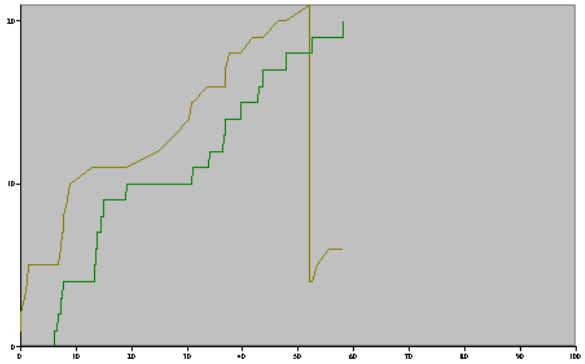

Figure 8 the batching and separation parameters of the system

IV. CONCLUSION

In this research we have concluded raw cardiac signal i.e. ECG signal with the help of specification. By using various filters like band pass filter and derivative filter, we have removed noise from ECG signal and calculated amplitude of P-wave. Also, we have done P-wave normalization and QRS detection.

QRS detection is done for detecting a P- wave. Because p wave have very small amplitude so it is very difficult to find out. Furthermore, the statistical results will be obtained by thresholding method.

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