ISSN 2349-7815

International Journal of Recent Research in Electrical and Electronics Engineering (IJRREEE)
Vol. 3, Issue 1, pp: (5-9), Month: January - March 2016, Available at: www.paperpublications.org

A Review on Arrhythmia Detection Using ECG Signal

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Abstract: **Electrocardiogram is a machine that is used for the detection and the analysis of the peaks of the ECG signal. ECG signal is used for the detection of various diseases related to the heart. The cardiac arrhythmia shows abnormalities of heart that is considered as the major threat to the human. The peaks that are present in the ECG signal are used for detection of the disease. The R peak of the ECG signal is used for the detection of the disease, the arrhythmia is detected as Tachycardia and Bradycardia. This paper presents a study of the ECG signal, peaks and of the various techniques that are used for the detection of disease.**

Keywords: **Heart diseases; ECG signal; Cardiac arrhythmia.**

I. INTRODUCTION

The Heart ailments are the most widely recognized infection that has influence people around the world. The utilization of biomedical instrument particularly for cardiovascular system helped a lot in reducing untimely death sue to heart failure. Cardiovascular diseases (CVD) are the most well-known reason for death. Of these more than seventy five percent take after coronary conduit ailment and stroke

Determination of CVD is regularly done by listening to the heart-sounds, ECG or by ultrasound. Cardiologists are the specialists who concentrate on sicknesses of the heart. The key elements of this increasing hazards are overweight, smoking, hypertension, elevated cholesterol, diabetes etc.

ECG stands for electrocardiogram this is tool that is used to record even of the small electric waves being generated during heart activity., it is measured by keeping electrode plates on patient's body, with the help of these electrodes even the small electrical change on the skin that arise from the heart muscle during each heartbeat is detected. Ten electrodes are used in 12 lead ECG. The main work of ECG signal is to analyze and estimate the heart rate. It will record electrical and muscular function of the heart during a time interval. It is also known as EKG. Various diseases can be detected by using ECG signal. ECG plays vital role in the diagnosis of the cardiovascular disorders as this effective, simple, Antenatal and low cost procedure .Cardiac arrhythmias can be detected by using an ECG signal. By determining the various features present in the signal various arrhythmias, like tachycardia and bradycardia. The R- peak that is present in the ECG signal is used for the detection of the disease. The detection of the disease is very important , if the disease is not detected at the proper time it can leads to the problem that can even cause death .

ECG Arrhythmia:

Any of the disorder or abnormality in the normal activation sequence of the myocardium is called cardiac arrhythmias. There are various symptoms of Cardiac arrhythmias that can range from no loss to sudden death .The sinus node, spontaneously depolarizes, depolarizing the atrioventricular node, displaying properties of automaticity etc can help in detection of disease. The presence of various structural heart diseases can cause server problems. There are two type of arrhythmia on the basis of the R-R interval.

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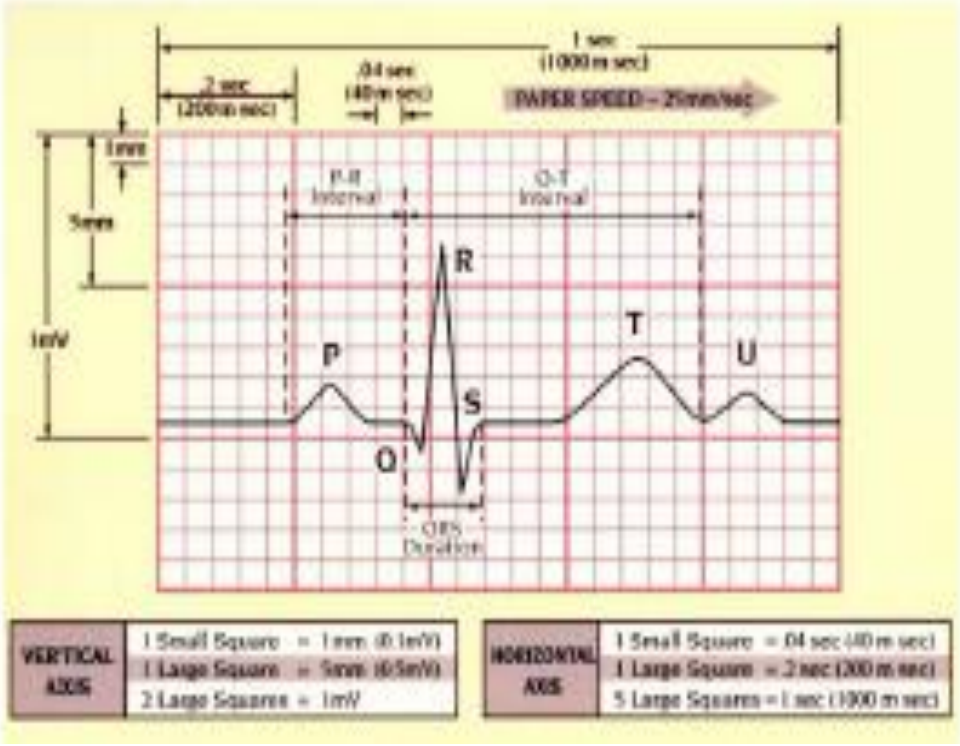
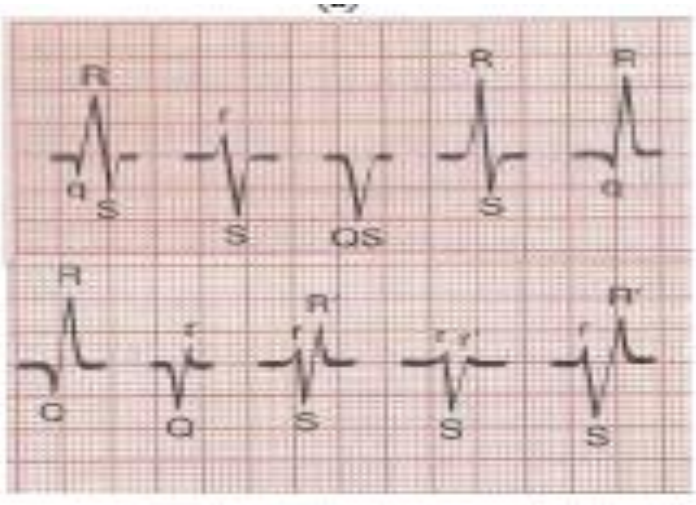
a) Bradycardia b) Tachycardia

Bradycardia: - In bradycardia the heart rate is less than 60 beats/min. The patients with increase in the pressure, myxoedema and jaundice can raise the effect of the bradycardia.

Tachycardia: - In tachycardia the heart rate is greater than the 100 beats/min the presence of ectopic focus in the atrium, that beat regularly cause the tachycardia



(a)



(b)

Fig 1 (a) ECG waveforms and intervals, (b) Common QRS Complexes [4]

II. PEAKS OF THE ECG SIGNAL

An ECG signal consists of the five peaks i.e. PQRST. These peaks will help to detect the disease

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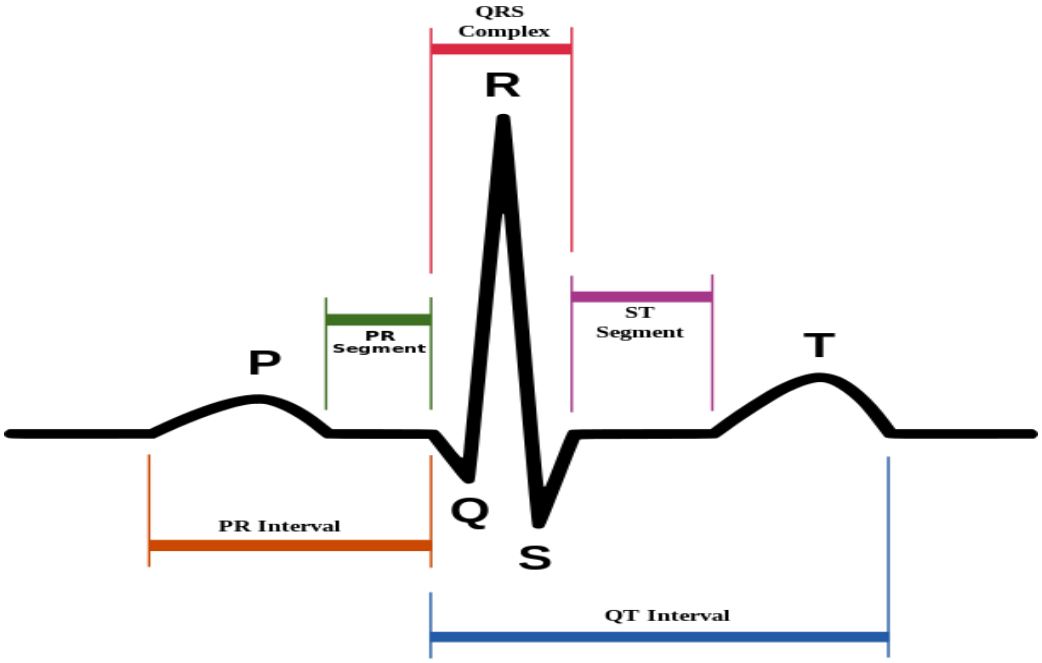

Fig 2. Peaks of ECG signal

P wave: - This wave in ECG results in the atrial contraction as it represents the atrial depolarization

Q wave: - This wave represents the first negative deflection in the ECG signal.

R wave: - This wave will represent the first positive deflection in the ECG signal.

S wave: - After the positive deflection of the R wave next negative deflection is represented by the S wave.

T wave: - This wave represents the ventricular repolarization in the ECG signal.

PR interval: - This is used to measure the time interval during which the depolarization wave travel from atria to the ventricles.

QRS Interval: -This interval includes the three deflections following P wave which indicates ventricular depolarization.

ST segment: It measure the time between ventricular depolarization and the beginning of the repolarization

QT interval: This interval in the ECG signal represents the total ventricular activity of the heart.

III. RELATED WORK

ECG signal can be used for the detection of the various diseases .Various contributions have been made in literature regarding noise removal, Feature extraction and classification of ECG signal.

F. Yaghouby et al [1] in this paper the four major cardiac arrhythmias i.e. left bundle branch block, fist degree heart block, Supraventricular tachyarrhythmia and ventricular trigeminy can be detected. On the proposed methodology the heart variability signal is used for the classification of the arrhythmia. This method is based on the Multilayer perceptron neural network classifier and the Generalized Discriminant Analysis (GDA) feature reduction technique

R. Ganesh Kumar et al [2] presents the classification method for the arrhythmic beat classification using RR interval. Discrete cosine transform conversion of the RR interval is done. The RR intervals that are extracted from the ECG signal are used as the feature. MIT-BIH arrhythmia database was used for the conducting the various experiments

Rabee A et al [3] presents a new method for the classification and the analysis of the ECG signal**.** With the help of discrete wavelet transform and the Support vector machine this new method is proposed. The methodology is divided into three stages i.e. Signal processing, feature selection and the classification of the ECG beats. In this proposed methodology 17260 ECG beats were selected from the MIT/BIH arrhythmia database.

Sameer K. Salih et al [4] presents an approach for the detection of the QRS complexes of the ECG signal and the RR intervals of the signals. The MIT-BIH Arrhythmia have been used to evaluate the proposed technique .Also the comparison of the traditional techniques is done. It is considered as the best comparable method.

Saleha Samad et al [5] present a technique for the detection of the arrhythmia in which three classifier are compared. The supervised machine algorithm is used that depend on the accuracy rate. The classifiers that are used for the comparison are nearest neighbor, Naive Bayes', and Decision Tree classifier. Using this algorithm the calculated accuracy of K-NN was 53%

Shahram, M et al [6] this paper presents an algorithm for classification of the multichannel ECG into normal and abnormal categories. A sequential beat clustering algorithm and a cross distance algorithm is used. The 1-lead and 2-lead ECG are both developed with the help of this proposed algorithm. From the results obtained it is observed that the classification error for 1-lead is less than 1% and is 0.2 % for the 2-leads with 0.2% clustering error.

IV. METHODLOGY AND PRINCIPLE OF ECG

Principle:

ECG is the device that is used for the detection or the amplification of the change on the skin that is due to the change in the heart muscle with each heart beat. Membrane potential is the negative charge that heart muscle has when it is at rest across its cell membrane. The contraction of the cell is due to the process of depolarization. Depolarization is the process of the decreasing of the negative charge towards the zero, via the influx of the positive cat ions. A healthy heart on each heart beat will have an orderly progression of a wave of depolarization that is trigged by the cell that is present in the senatorial node that spreads through the atrium, it will next move through the atrioventricular node and will finally spreads over the ventricles. Two electrodes are placed on the either side of the heart that will detect the rise and fall in the voltage that is displayed by the line on a screen.

Methodology of the ECG:

The detection of the beat in the ECG signal is divided into four stages:

i)Input ECG signal ii) Preprocessing

iii) Feature selection iv) Classification

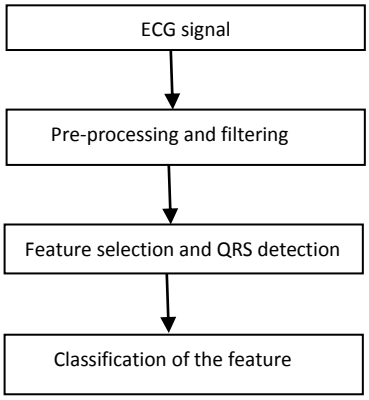

Fig 3: Block diagram of beat detection in ECG signal.

Step I: - Initially the Raw ECG signal of the data base is taken and uploaded. In this two ECG signal overlapped.

Step II :- In this step the preprocessing and the filtration of the input signal is done , As signal consist of different type of noises, so filtration is done with the help of the filters.

Step III: - In this step the selection of the feature is done**,** that are used for the detection of the QRS interval of the ECG signal

Step IV: - In this step the classification of the features that are selected are done on the basis of which the disease is detected.

V. CONCLUSION

ECG is the process for the detection of any sort of the change that is made in the heart during each heart beat. It is an analysis system that is used to measure the rate and the regularities of the heart beat. This output of the system should of good quality and accurate so that the problems related to heart should be correctly detected. The ECG signal has PQRST peaks that are used for the detection of the disease. After studying the literature it is concluded that traditional work over the detection of the features is done by using Wavelet transform , Artificial Neural network , SVM etc but these system were complex, also the features obtained were not much informative. So to increase the accuracy of the peak detection for the disease detection with less error and to evaluate the performance of the ECG signal analysis further work can be done using some other technique.

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