Early Stage Detection & Preventive Measures for Sudden Cardiac Arrest

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***Abstract*— In the following described paper, the differential based algorithm is used. This method analyzes different samples of heart pulses and based on above mentioned technique it will classify which kind of pain victim is suffering from.**

Keywords*— Oximeter, Atrial Fibrillation, Arrhythemia, QRS Complex, Threshold.

I. INTRODUCTION

Cardiac arrest is a global leading cause of death for both gender and the occurrence is not always known to us. Heart Rate is calculated usually by various devices. It used most commonly in the form of pulse oximeters or Electrocardiogram devices. Though these devices are bulky but are reliable for users. However, these devices require users to perform their process. In this, we propose a system capable of estimating the heart beat rate. This uses a differential based algorithm which compares between normal and abnormal cases of all patients. Generally this pain is not differentiated by the patients which leads to major contribution of death. Our research is about to determine this problem earlier to reduce the death rate of Cardiac arrest. The advantage of this method is that the user does not need specialized hardware and he/she can take a measurement in virtually any place under almost any circumstances. In addition, the measurement can be used as a tool for health coaching applications or effective telecare services aimed in enhancing the user's well being.

A normal heart rate is 60-80 beats per minute, but during a heart attack that rate is altered due to the disrupted blood flow. Heart rates during a heart attack can vary from too slow or fast to palpitations and even skipped beats. Where the blockage in the heart occurs often has a direct correlation on the type of heart rate. people who suffers from heart diseases such as heart valve problems, heart attacks, long-standing high blood pressure may also suffer from atrial fibrillation, but there is a probability that healthy people can also suffer from this disease. Because of this the atria are not able to pass the electrical impulse smoothly like a ripple traveling across a calm water pond as it becomes scarred and irritable. Instead, the electrical impulse breaks up into many smaller ripples that travel around the atria in a very fast, irregular and disorganized manner much like a stormy ocean surface. This increases beat rate of atria generally between 300-600 beats/minute. A proportion of these impulses travel down the AV node and cause the ventricles to beat quite fast (120-190 beats/min) and very irregularly. Increased beat rate of atria causes the blood to pumped abnormally which leads to clotting of blood in atria. Atrial fibrillation is often very difficult to control with drugs. This leads to cause a severe arrhythmia.

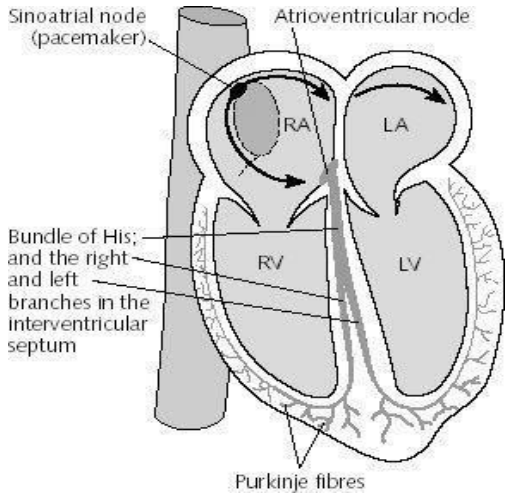

Fig.1-schematic representation of heart's electrical system[5]

II. ELECTROCARDIOGRAM

An ECG test is painless and harmless. Small metal electrodes are connected on to your arms, legs and chest. Wires from the electrodes are connected to the ECG machine. The electrical impulses in your heart can be detected by the ECG machine which records them on to a paper or computer. An ECG is able to confirm an arrhythmia at the time of the test. Different arrhythmia cause different ECG patterns, so this test can often clarify the type of arrhythmia. Normally, the frequency range of an ECG signal is in the range of 0.05–100 Hz and its dynamic range is of 1–10 mV. The ECG signal is characterized by five peaks and valleys labeled by the letters P, Q, R, S, T. another peak called U is also used in some cases. The performance of ECG analyzing system depends mainly on the accurate and reliable detection of the QRS complex, as well aT- and P-waves.

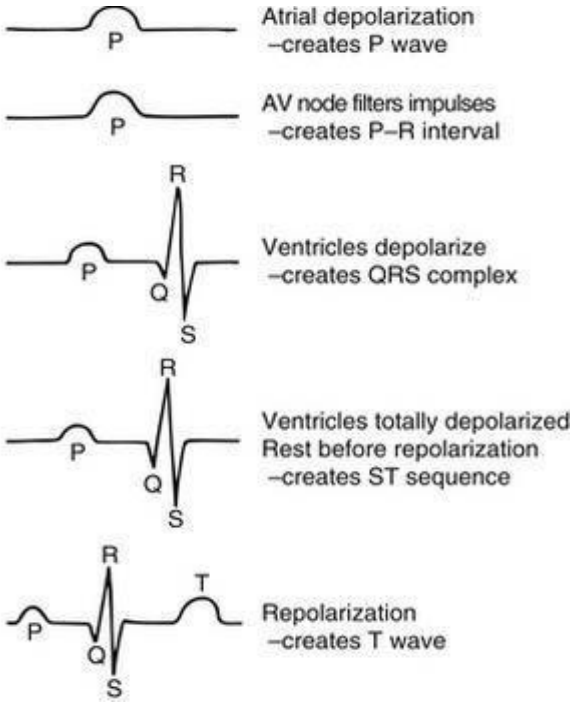

Fig.2-sequence of events making heart to beat [6]

Heart beating is process which is first excited by pacemaker cell that already exist in heart**'s** upper right atrium part**.**. Pace maker cells suddenly changes its own potential which give rise to change in potential of surrounding heart cells. Now this energy gradually transfers towards the ventricle part that result in the formation of 'P' wave of smaller peak. When this polarization wave propagates through the ventricle part which contains large amount of heart cells that pumps large potential resulting in 'R' wave of maximum peak. When wave further propagates to the bottom part of ventricle part its amplitude decreases and goes negative. Since it is a natural phenomenon, surrounding field supports polarization wave which results in initiation of depolarization wave which again transfers to atrium part resulting in formation of 'T' wave. This process continues making our heart to beat.

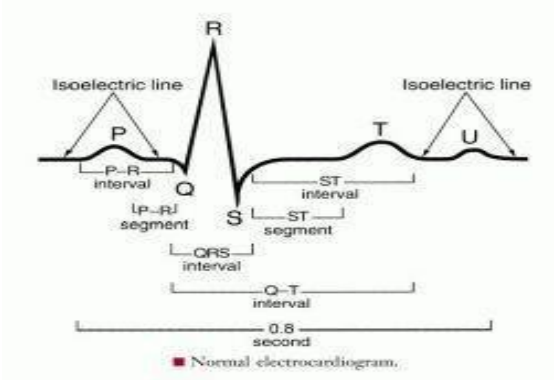

Fig .3-normal ECG waveform[7]

Amplitude P-wave — 0.25 mV
R-wave — 1.60 mV
Q-wave — 25% R wave
T-wave — 0.1 to 0.5 mV
Duration P-R interval : 0.12 to 0.20 s
Q-T interval : 0.35 to 0.44 s
S-T interval : 0.05 to 0.15 s
P-wave interval : 0.11 s
QRS interval : 0.09 s

III. METHODOLOGY

A. processing of QRS complex

When any malfunctioning occurs in a heart it affects and obstructs the normal flow of heartbeat process which results in arrhythmia that can be observed by variation in amplitude and duration of QRS pulse. Our aim is to analyze these QRS pulses obtained from ECG of a victim and to classify it as either normal or affected condition of heart. To do this we will first observe the normal ECG pulses nut as it varies from person to person, instead of defining a exact value we will calculate average value and treat it as a threshold. This threshold is based on both amplitude and time duration of pulses, as malfunctioning of heart causes changes in both amplitude and duration.

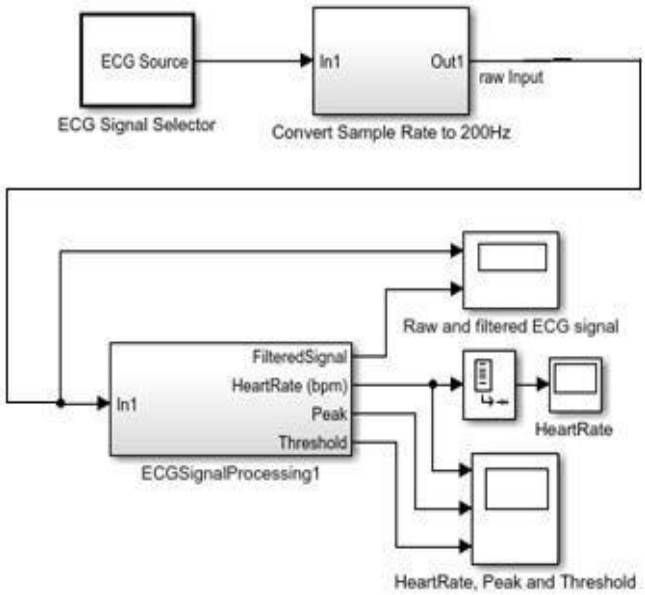

Fig. 4- Processing of QRS complex [1]

We proposed a system which uses the differential algorithm being developed based on this threshold. This system contains ECG source that takes ECG sample of a person and inputs it to a sampler which develops a discrete form. ECG processing block takes this as input and processes the threshold predefined in it, heart rate, and amplitude. Based on this processed output the condition of heart is determines as normal or severe and accordingly it guides to diagnose the victim by providing appropriate treatment.

B. Simulation on Software

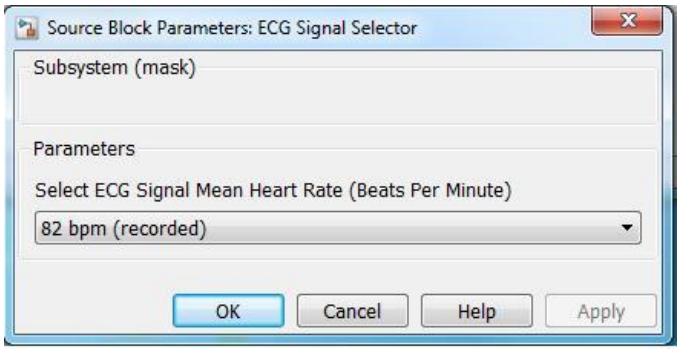

Fig 5-ECG signal selector block in which heart rate is given in BPM.[1]

Simulation Software describes the results of various ECG waveforms with heart rate ,peak ,threshold which is useful in defining different pains in heart; which is as shown in the fig.6.this simulator takes the ECG of an patient as an input and the differential based algorithm process to give the respective output ; which will lead to an preventive measures.

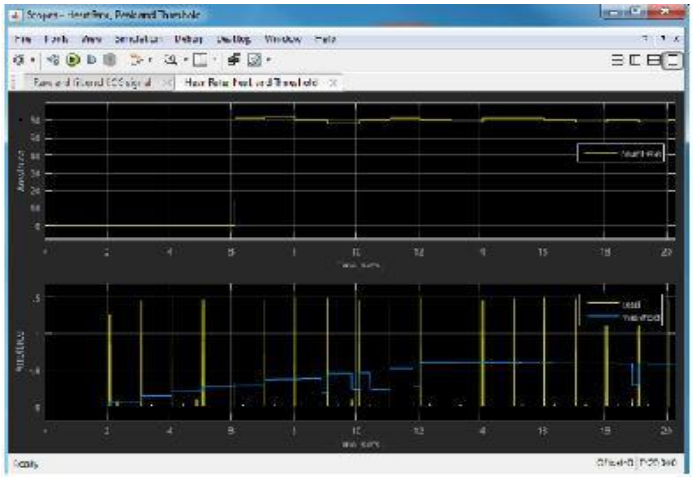

Fig.6-matlab simulation [1]

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V. FUTURE SCOPE

Based on the present idea we can classify the various kind of pain the victim is suffering from. We can further think of designing the probe detection device which will measure the thickness of carotid artery. Using the differential algorithm a threshold will be defined for the same. This can further be used for people of all age groups. One can design the database for the same which can be updated through IOT. The probe can also be designed to have a system installed wherein it will maintain a database containing the records of all the data related to all heart patients. Using this database, the data will be analyzed. Depending on this if a severe case of heart disease is found then it will alert the victim. Also the system installed in the device can contact the patients' relatives using the data registered in it, also it can call for a ambulance or nearest emergency medical facility. So this will provide great help to heart patients and death rate due to the sudden cardiac arrest will be controlled because of the early detection and preventive measure.

VI. CONCLUSION

Till date there has been many devices developed for the better treatment procedure; but the treatment alone is not sufficient to save a patient's life in vigorous and intense conditions, so these project basically is a device(system) that helps to give an early indication to each and every person by using their Blood Pressure, Temperature and Heart Rate ; basic 3 parameters with the measurement of carotid artery thickness will produce an accurate results about whether a person is suffering from cardiac arrest or not just by comparison and differential base algorithm as mentioned in the above methodology of papers .

VII .REFERENCES

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