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A Study on ECG Signal Processing Applications of High-Performance Digital Filters

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***Abstract** –Electrocardiogram (ECG) is the transthoracic interpretation of the electrical activity of the heart over a period of time. Analysis of ECG signal provides information regarding the condition of heart. Various methods like Fast Fourier Transforms, Wavelet Transform, etc. have been used for detection of cardiac diseases In this paper we have given a review on the work done in area of ECG signal analysis in past few years.*

***Keyword:-**Electrocardiogram,Heart, Electrocardiogram (ECG), Wavelet Transforms*

I – INTRODUCTION

An electrocardiogram (ECG) is a bioelectric signal that measures the heart's electrical activity over time. Heart disease research relies heavily on this technique. Heart disease is a major factor in the rising death toll in the human population. The unexpected death of a cardiac patient can be prevented if the condition is diagnosed and treated early enough. Heart illness can be diagnosed with the aid of an ECG. The electrical activity of the heart is recorded by placing electrodes on the skin. In most cases, the ECG signal's amplitude is in the 0.1 mV to 3 mV range [Seema et al, 2011]. ECG signals have a frequency range of 0.05 to 100 Hz. The P wave, QRS complex, and T wave combine to generate an ECG signal, as depicted in figure 1.1. In 59 to 70 percent of EGCs, a faint U wave can be seen. Left and right atria activation can be seen on the P wave. The depolarization of the left & right ventricles is represented by the QRS complex. Repolarization of the ventricles is depicted by the T wave complex.

II -ANALYSIS

In this paper, we study how to make a decryption key more powerful in the sense that it allows decryption of multiple ECG.

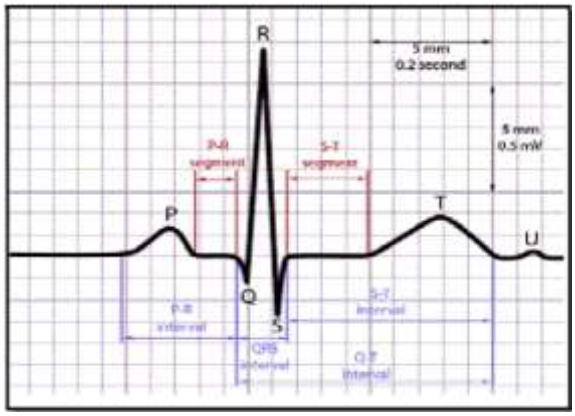

Fig 1.1 Normal ECG Signal

The varying values of these markers point to a heart condition. Arrhythmia is an abnormal heartbeat, and some arrhythmias can be exceedingly dangerous for patients.. AC interferences, loose electrode connections, the malfunction of the machine, and the patient's motions, such as respiration, can cause the ECG signal to be corrupted. Medical monitoring devices provide a thorough comprehension of the biomedical signal recording & demand more exact data for the diagnostic. When a patient is being diagnosed, it is difficult to achieve an accurate ECG signal recording result [Aleen 1994]. Any surrounding machinery's electromagnetic

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field has the potential to contaminate the ECG signal [Wei 2003]. The output of an ECG signal can be damaged when a patient is being diagnosed in a hospital or someplace else by this 50-60 Hz noise. Because of interference noise from the power source or the environment, it is impossible to get an exact reading from an ECG signal recording. There are groups of sodium (Na+) & potassium (k+) ions in the blood that form an electrical ECG signal.

A recording bandwidth of 0.1 to 120 Hz is required for the ECG signal, which is normally in the 2 mV range. Electrodes attached to the surface of the human body can capture the ECG signal, which is created by the heart's rhythmic contractions. Signals gathered at each electrode and subsequently recorded. There are 12 different leads I, II, III, AVR, AVL, & AVH, while the chest leads are V1, V2, V3, V4, V5, and V6. Pictured in figure 1.2 is the original ECG signal downloaded from the MIT-BIH database (Massachusetts Institute of Technology-Beth Israel Hospital).

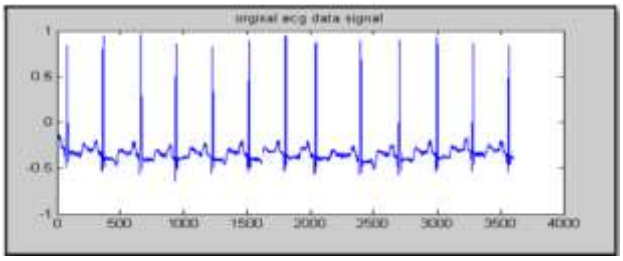

Fig 1.2 ECG data signal for record No. 222 MIT-BIH database

RLS algorithm, LMS & NLMS algorithm and SSRLS algorithm of adaptive filtering are some of the strategies being used by researchers to remove noises. Chebyshev filters, IIR filters and Zero phase filtering are also being used to remove noise. In this study, nine window approaches of the FIR (Finite Impulse Response) filter were utilized to reduce the noise of distinct ECG data signals. Neural networks trained for window-based FIR filters aren't mentioned anywhere in the survey.

III -DESIGN

The methodological approach analysis of the procedures used in a particular field of study is known as methodology. It is the study of a field's corpus of methods & principles from a theoretical perspective. Paradigm, theoretical model, and phases are typically included in this category. As the name suggests, the term "research" refers to the process of gathering information and understanding about a specific subject or issue. To put it simply, research is the practice of conducting a thorough examination. Electrocardiography (ECG) is a technique that uses electrodes applied to the skin to record the electrical activity of the heart. Since the peak-to-peak signal is only 0.2 to 2 millivolts, the bandwidth is only 0.05 to 150 hertz, and there is 50 hertz/60 hertz interference, signal conditioning in this application is difficult. The ECG has been used extensively to identify a wide range of heart conditions. Low power consumption, latency, and higher system performance are all advantages of an FPGA-based ECG machine architecture. High performance ECG system chips on Virtex-5 FPGA are built and synthesized in the study, and real time patient heart beat detection validation is carried out.

IV-CONCLUSION

An electrocardiogram (ECG) is often performed by a skilled pharmacologist, electro physiologist, cardiologist, and anesthesiologist. Heart beat electrical behavior is provided by the ECG technology, which produces an impulse wave in heart that causes muscle contraction and blood flow into the heart. Cleaning and shaving the area where metal circles or anodes are located on the arms, legs, & chest is done during the ECG process to provide a pristine, smooth surface for the ECG lead wires. ECG gel or alcohol-soaked pads placed between lead wires and skin can help improve electrical impulse transmission. On each arm and leg, and on your chest, the 12-leads are linked to skin. These devices are linked to an ECG machine, which records the heartbeat on paper. In older ECG machines, the leads are moved across the chest to identify the electrical activity of the heart. The ECG signal has a significant role in biomedical science, and the information provided above serves as an impetus for further study in the area.

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