A RECONFIGURABLE OVERLAPPING FFT/IFFT FILTER FOR ECG SIGNAL DE-NOISING

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Abstract: Dynamic electrocardiograph (ECG) monitoring (known as Holter) plays an important role in the earlier detection and diagnosis of various cardiovascular diseases. These noise include, power-line interference, baseline wandering, high frequency artifacts, and other biomedical produced in human body. The main objective is to de-noise the ECG signal and produce noise free signals. Now a days, ECG equipment can be handled at home with the help of portable system Holter monitor. In such system the result have to be very accurate, hence denoising of the noise is very important. Here a reconfigurable filter which is configured to work as band pass and comb filter is used and it suppresses both high frequency artifacts and power line interference. To solve the problem, a reconfigurable overlapping FFT/IFFT filter for suppressing the power line interference and the high frequency noise.

Keywords: FFT/IFFT filter, band pass filter, comb filter.

1. INTRODUCTION

DSP manipulates different types of signals with the intention of filtering, measuring, or compressing and producing analog signals. Analog signals differ by taking information and translating it into electric pulses of varying amplitude , whereas digital signal information is translated into binary format where each bit of data is represented by two distinguishable amplitudes. Another noticeable difference is that analog signals can be represented as sine waves and digital signals are represented as square waves. DSP can be found can be found almost any field, whether it's oil processing, sound reproduction, radar and sonar, medical image processing, or telecommunication essentially any application in which signals are being compressed and reproduced.

2. LITRATURE SURVEY

Min Dai and Shi-Liu Liana [1] the paper titled as "Removal of Baseline Wander from Dynamic Electrocardiogram Signals" The main objective is the traditional method which was based on moving average filter can remove the baseline wander in electrocardiogram signals, but also causes the loss of motive ECG signals, which makes distortions of filtered ECG signals are the drawbacks of this paper.

Arunachalam, S.P [2] the paper titled as "Real-Time Estimation of the ECG-Derived Respiration (Edr) Signal Using A New Algorithm for Baseline Wander Noise Removal" The main objective is real-time algorithm for estimation and removal of baseline wander (BW) noise. The estimated baseline was interpolated from the ECG signal at midpoints between each detected R-wave, More investigation is also required for comparing the results of this algorithm is the drawback of this paper.

Ziarani A.K., Konrad A [3] the paper titled as "A Nonlinear Adaptive Method of Elimination of Power Line Interference in ECG Signals" The main objective is the adaptive digital filtering method for the power line interference reduction. This method employs, as its main building block, a recently developed signal processing algorithm capable of extracting a specified component of a signal and tracking its variations over time, low computational resource availability and low sampling frequency is the drawbacks of this paper.

METHODOLOGY

The main objective is to de-noise the ECG signal and produce a noise free ECG signal. Now a day, ECG equipment can be handled at home with the help of portable system Holter monitor. In such system the results have to be very accurate, hence de-noising of the noises is very important. Here a reconfigurable filter which is configured to work as bandpass and comb filter is used and it suppresses both high frequency artifacts and power line interference. Noise free ECG signal is obtained from MATLAB high frequency noise and Power line Interference noise are added to the signal. Normally 3000 samples of ECG are taken per person. Here 1024 samples are processed. The process is done by taking 256 samples at a time. Hence to de-noise 1024 samples of ECG signal, the process is repeated four times. The signal is converted to text format and the signal is saved in Buffer Memory.



a.Buffer Memory where the ECG signal with noise is stored.

- b. FFT Block that used in conversion of the ECG signal in time domain to frequency domain.
- c. Filter Block that is used to detach the noise component.
- d. IFFT Block that is used in obtaining the filtered ECG signal in time domain.

4. SOFTWARE REQUIREMENTS

4.1 MATLAB Supported Platforms Windows, Mac, Linux Product Requirements DSP System Toolbox recommended

MATLAB

MATLAB (matrix laboratory) is a fourth-generation high-level programming language and interactive environment for numerical computation, visualization and programming. It allows matrix manipulations; plotting of functions and data; implementation of algorithms; creation of user interfaces; interfacing with programs written in other languages, including C, C++, Java, and FORTRAN; analyze data; develop algorithms; and create models and applications.

4.2 The MATLAB language

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

4.3 The MATLAB working environment

This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications.

4.4 Handle Graphics

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete Graphical User Interfaces on your MATLAB applications. 4.5 The MATLAB mathematical function library

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms. 4.6 The MATLAB Application Program Interface (API)

This is a library that allows you to write C and Fortran programs that interact with MATLAB. It include facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

5. CONCLUSION

In this we have developed ECG artifact removal algorithms suitable for clinical application. Specifically, solutions that can be applied to surface measured EMG signals that are used as prosthetic control channels. This implies the algorithm must satisfy significant processing limitations of memory and delay since it is implemented real time in the prosthesis controller. The filtered signal is similar when compared to noise free ECG, EEG and EMG. The suggested method is an effective, robust, consistent and computationally cheap algorithm .Which does not require training data and works fully automatic and independent of the specific subject. Additionally, the adaption to a real-time system is possible

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