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REMOVING OF ARTIFACTS FROM BIOMEDICAL SIGNALS BY USING DWT AND ANC ALGORITHM IN REAL TIME SENSOR APPLICATIONS

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Abstract: ***Embedded technology place an important role in biomedical application. Our method helps to filter the ocular artifacts in EEG signal using discrete wavelet transform (DWT) and adaptive noise cancellation (ANC) algorithms. Record the signals around the scalp using the electrodes. Here used surface electrodes that will attach on the skin.EEG signal is important in E-health care system especially in mental health care in the context of OPTIMI project light weight wearable sensor having designed here then apply the algorithm based on DWT and ANC to remove OA signal from original EEG signal.***

Keyword: discrete wavelet transforms, adaptive noise cancellation, ocular artifact, EEG signal

I. INTRODUCTION

Adaptive noise cancellation and discrete wavelet transform algorithms are used to extract the artifacts from the signals. Hardware and software components are used to implement the system. The system consisting various hardware's like Sensor, Electrodes, microcontroller, etc. Software's like MP lab, MATLAB here we are going to extract the EEG and EMG signals.

Embedded technology place an important role in biomedical applications. Our method helps to filter the artifacts in biomedical signals using discrete wavelet transform (DWT) and adaptive noise cancellation algorithms. Record the signals around the scalp using the electrodes. Here I use surface electrodes that will attach on the skin. In this optimizations technique are going to analyse and remove the artifacts in the EEG and EMG signal using DWT and ANC. Thus has reduced side effects increase the contact between skin and electrodes so quality of signals is high it can give continuous monitoring and real time system. It can remove the ocular artifacts, power line interferences and so on.

II. PROPOSED TECHNIQUE

This proposed optimization technique thus has reduced side effects increase the contact between skin and electrodes so quality of signal is high it can give continuous monitoring and real time system. it can remove the ocular artifacts in EEG and EMG signals using DWT and ANC algorithm.

III. METHODOLOGY

EEG signals are taken from electrodes positioned on the forehead. The scalp electric potential amplitude is typically 20 to 100 µV. Signal data can be contaminated by non-cerebral potential interference such as electromyography (EMG) from muscle activity or baseline drift and power line interference (50/60Hz), etc. Also, since the electrode points of Fp1, Fpz and Fp2 are so close to eyes, the recorded data are likely to be distorted seriously by eye movements and blinks. An eye blink produces signal amplitudes of more than 10 times that of the ambient EEG signal. Eye movements can also be recorded during the EEG collection trial, even when the subjects keep their eyes closed. It is necessary to develop an efficient method for removing the noise caused by eye movements. Traditional approaches to attenuating ocular artifacts are based on time domain or frequency domain techniques. A number of investigations have applied Principal Component Analysis (PCA) or Independent Component Analysis (ICA). However, given that ICA needs a reference signal which requires tedious visual classification of the component. DWT is a method that neither relies upon the reference ocular artifacts nor requires visual inspection. We have developed a new model based on DWT and ANC cancellation to remove the ocular artifacts. This is conducted as follows. First step is to construct a reference signal with DWT. With this reference signal, a new model is established based on ANC, hence a combination of DWT and ANC. It is our contention that this is a novel and effective approach, particularly suitable for portable applications, even if the EEG signal has only one channel. OA are mainly concentrated in the low frequency band, so DWT is used to construct the OA in the frequency domain. DWT is a multi-resolution representation of signals and images. It can be used to decompose signals into multi-scale representations. It is widely used for analysing non-stationary signals.

The wavelets used in DWT are effective in constructing both time and frequency domain information from time-varying and non-stabile EEG signals. An alternative method of estimating signals, corrupted by additive noise interference, is to apply an ANC adaptive filter. In an ANC filter, the interference source is used as a reference when adjusting coefficients automatically to achieve optimal results. The combination of DWT and ANC is new model. Derived from the contaminated EEG, An ANC based on RLS algorithm is adopted to remove OA. This method works as follows. Wavelet decomposition is applied to expand the contaminated EEG signal so as to get the wavelet coefficients.

Daubechies 4 wavelet is selected as the mother wavelet function. According to the minimum risk value, the soft threshold is applied to the three lowest level coefficients to obtain the new coefficients for those three levels. Wavelet reconstruction is applied to the new wavelet coefficients for constructing the reference signal. ANC is applied to the contaminated EEG with the constructed reference signal as an input to remove the OA. In OPTIMI, a filter from 0.5 to 40Hz frequencies has been adopted to avoid the influence of power line interference. The new model proposed in this paper removes the OA from recorded EEG data. The results are sufficiently good t o facilitate feature extraction. According to the minimum risk value, the soft threshold is applied to the three lowest level coefficients to obtain the new coefficients for those three levels.

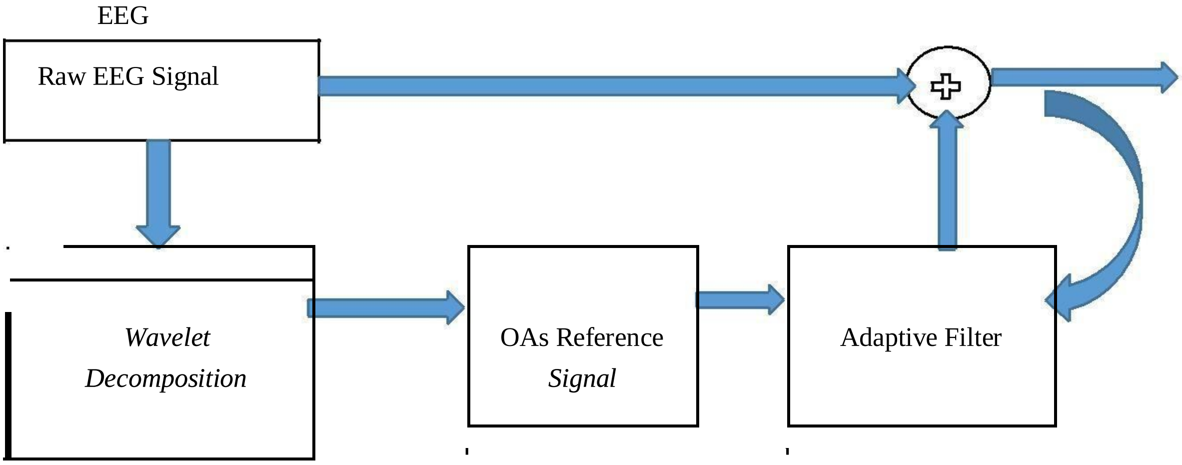


Figure 1 OA removal model combining DWT and ANC

IV. BLOCK DIAGRAM AND DESCRIPTION

Block diagram:

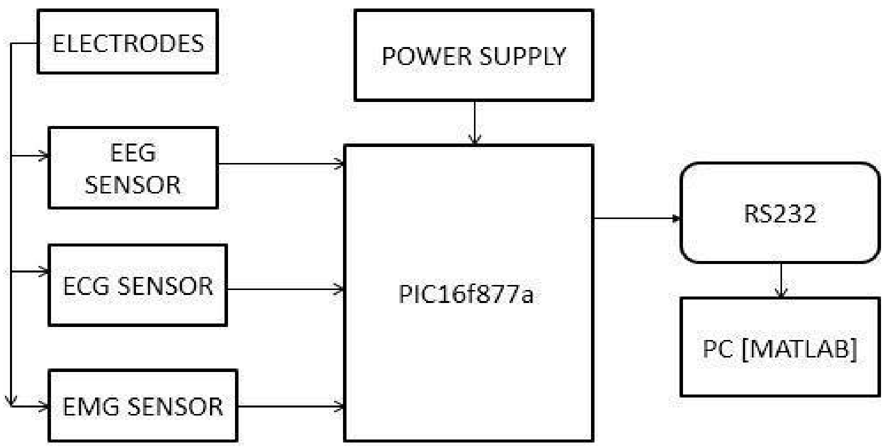


Figure 2 Block Diagram of the Proposed System

Description:

Surface Electrodes are placed on the human body and it will connected with the sensor unit the sensor sense the biomedical signals. The biomedical signals are very low amplitude because the signals to be amplified and given to the PIC microcontroller. It will converts the analog values into digital and then interface with the mat lab in the PC using Serial port USB RS 232.the coming signals having the artifacts like power line Artifacts, ocular Artifacts etc.

V. MATLAB RESULT

The Discrete wavelet transform and Adaptive noise cancellation techniques used in the MATLAB that will be removed from the given data.

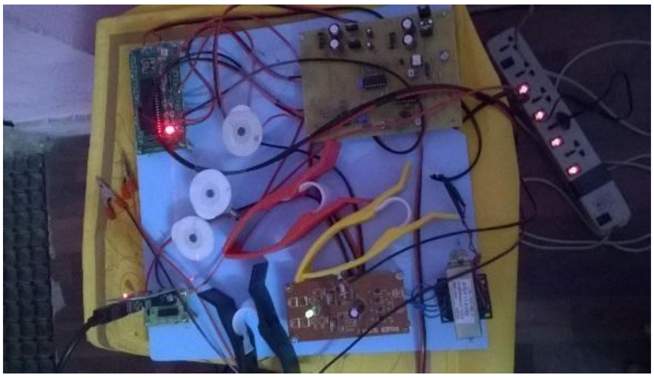
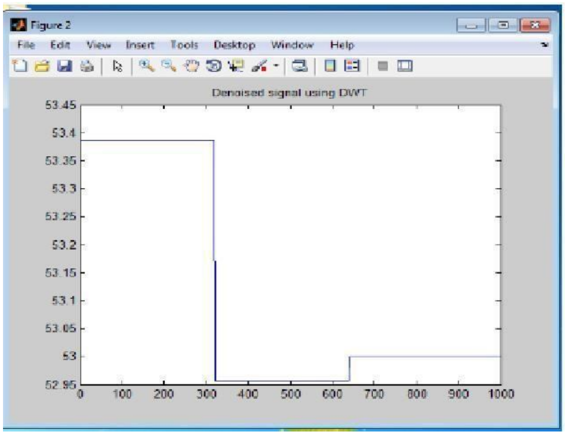


Figure 3 Experimental setup

VI. OUTPUT SIGNAL

EEG Simulation Result



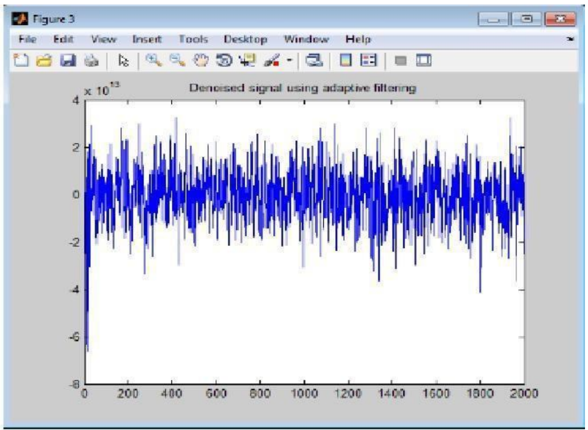
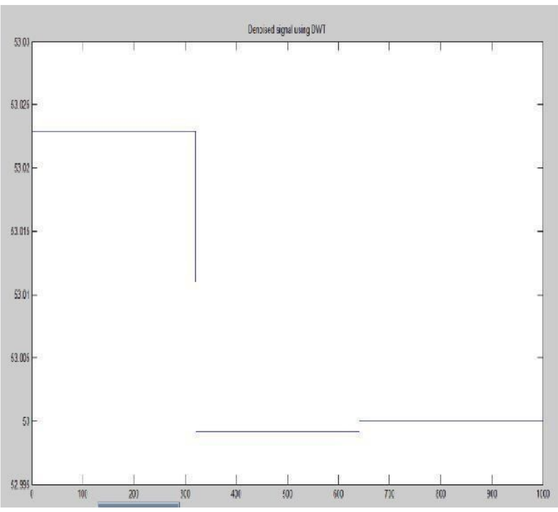


Figure 4 Denoising Using DWT

Figure 5 Denoising Using ANC

EMG Simulation Result



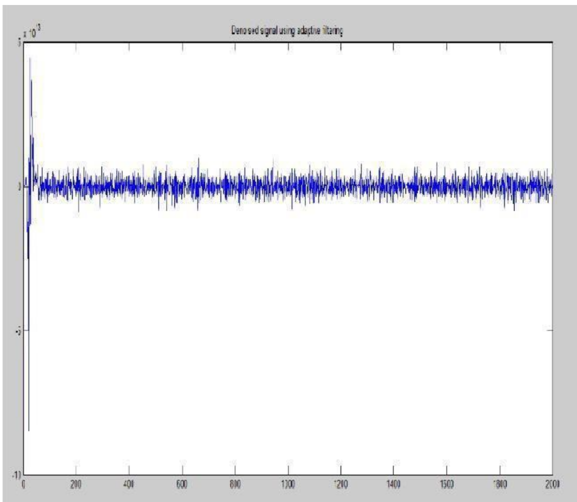


Figure 6 Denoising using DWT

Figure 7 Denoising using ANC

VII. SUMMARY

The required hardware can be connected and get the desired output. Here DWT is used for the reconstruction of signal for pre-processing and ANC is used to remove the noise. To obtain the denoising correctly DWT level should be low.

VIII. CONCLUSION AND FUTURE ENHANCEMENT

Artifacts removal is one of the major features in biomedical signal. Considering the lack of suitable low cost sensors, designed and produced a sensor that can be easily used by ordinary public in an everyday setting. In order to validate the sensor when used in normal/real-world conditions by a non-professional person. I have presented an algorithm to calculate biomedical signal quality with which the users can adjust the connection of electrodes to correct any errors and to suit the prevailing environment. The reported results show that our proposed method functions well, meeting the design goals/requirements and helping to ensure the quality of the signal. In addition, the sensor can also be used as a low cost diagnostic tool to meet the needs of large e-health trials. Use the telemedicine system to transfer the data. In future I can remove artifact from more biomedical signals and quality of the signal is improved by using different effective algorithms.

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