

Heart Rate Monitoring using PPG Signals for Yoga Postures

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Abstract:

Heart Rate (HR) monitoring is used to measure the heart pulses and control the fitness of our human body. In recent times, the condition of heart pulses are highly measured by Photoplethysmogram (PPG) signals which is used to monitor the heart rate signals. Further, these analyses are highly applicable for accurate results. Consequently, the method of this project is widely explain the collection of PPG signals for both practicing yoga, non – yoga subjects using microcontroller and LCD display. Finally, the resultant output is measured due to condition of heart pulses using PPG signals

Keywords: Heart Rate (HR) Photoplethysmogram (PPG). Motion Artifacts (MA).

I. Introduction

Heart Rate (RA) monitoring is one of the important tasks for exercisers to control their training load for fitness [1]. It is a silent feature for wearable devices such as Mio alpha heart rate sport watch, Samsunggear fit, and atlas fitness tracker. Further, these devices are calculate the heart rate in real time application using Photoplethysmogram (PPG) signals which is used to record the signals from hand wrist. Generally, the PPG signals are gained by pulse oximeters that gathered information using Light Emitting Diode (LED). It measures the heart rate through intensity of light changes which reflected from the skin, and then PPG signal is formed. Therefore, the continuity of PPG signal equivalent to cardiac rhythm and the heart rate can be calculating using PPG signal. Despite of, the PPG signals are highly attacked to

motion artifacts (MA). To meet out these several methods are proposed to remove the motion artifacts in the PPG signals. Kim et al. contributes a basic Independent Component Analysis (PCA) algorithm for removing block interleaving in motion artifacts [2]. The adaptive noise cancelation (ANC) was proposed to remove the MA from the reference signal like Fast Fourier transform (FFT), Single Value Decomposition (SVD) [3]. On other hand for removing artifacts such as time to frequency analysis, wavelet denoising, electronic processing and empirical mode of decomposition. After that, some of the new techniques are proposed based on clinical analysis such as walking [8] and finger movements but MA was not clearly eliminated by this technique. Finally, few techniques were proposed for HR monitoring system to record the PPG data from fingertip or ear [4]. By comparing with fingertip and ear lobe, the

wrist type may cause interference among the PPG signals, to avoid that different types of wearable devices are used for developing high performance value. Thus the proposed work focused on both hardware and software tools for monitoring PPG signals and analysis of PPG signals also calculated.[5,13]

II. Proposed Methodology

In this work, heart rate measured and monitored using PPG signal. For better understanding, the entire systems are drawn in Fig.1 with the help of both hardware and software blocks to measure the PPG signals. After the respective signals are collected from the finger using IR transmitter and receiver pair module for amplification, then amplified signals are passed through low pass filter to remove the noise signal. Finally, the acquired signals are stored in microcontroller and corresponding heart rate will be displayed on the LCD. [6,14]

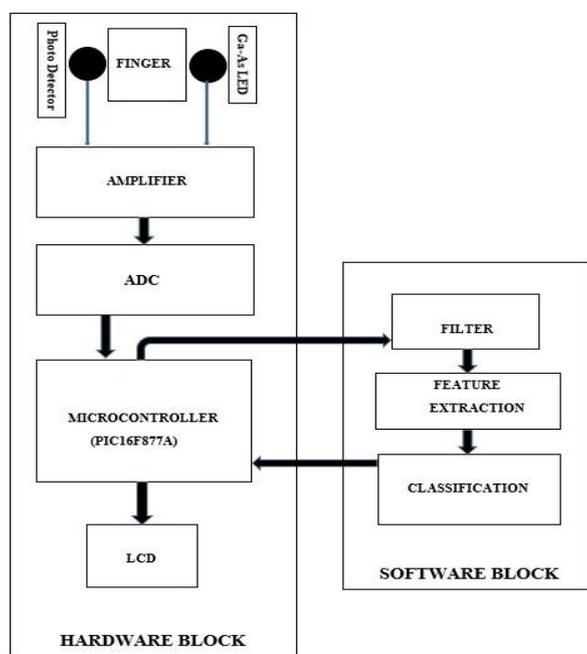


Fig.1 Block Diagram for monitoring Heart Rate (HR)

Therefore, the heart pulse signals are collected from practicing Yoga and Non- Yoga

subjects using feature extraction. Finally, the function of control system which influences the heart pulses during yoga Sana will pay the way for application of yoga in medical therapeutics.[7,12]

PPG Heart Response Protocol:

- It is developed to find the correlation between heart rate dynamics PPG Signals.
- PPG sensor is placed on the finger tip of the index finger. [10]
- Following the sensor placement PPG signal required from the practicing yoga and non-practicing yoga.
- Participants were requested to be seated on a chair.
- Signals were required from the participants with eyes closed for period of 120 seconds.
- The above task is repeated for three trials and the participants were being provided with inter trail rest period of 1 minute.
- During the collection of data they were requested to be ideal.
- In order to validate the PPG data visually inspected the PPG data collected from the practicing yoga and non-practicing yoga subjects.[8]

III. Result and Discussion

The result and discussion are compared with the groups of participants practicing yoga and non-practicing yoga. The criteria for the two groups were controlled with respect to the participant's age, gender, medication understanding the guide lines and cooperation. Then the classification accuracy and analysis of PPG signals are drawn according to the output.[9]

Age	20-30
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Gender	Male and Female Participated
Medication	Participants taking any drugs tranquilizer were excluded from the participation[11]

the subjects performing yoga and non-yoga subjects. Finally, it can be concluded with the result analysis of two people with accurate PPG signals.

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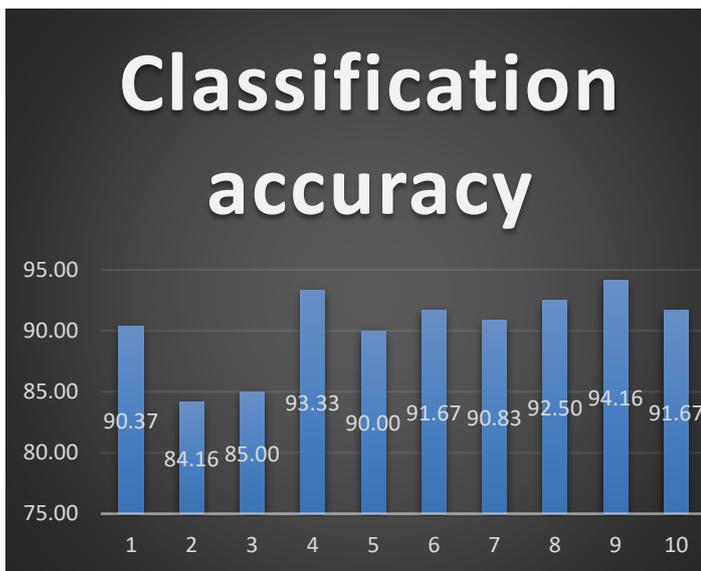


Fig. 2 Classification Accuracy

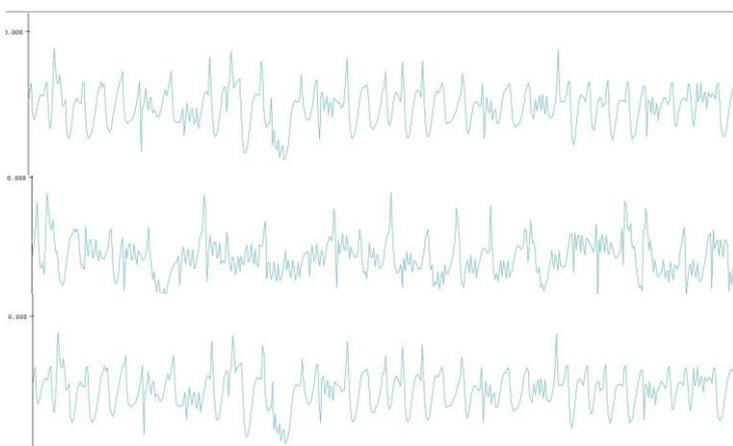


Fig.3 Analysis of PPG Signals

IV. Conclusion

Heart Rate analyses are highly used to measure the fitness of the people with the help of PPG signals. Our proposed work focused on different measurement of heart rate using both hardware and software tools for yoga postures. Then the heart rate has been measured from different subjects to know the variation between

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