CHAPTER 7

CONCLUSIONS

7.1 CONCLUSIONS FROM THE CURRENT RESEARCH

This work has obtained and used the information from the recorded PPG and ECG signals to calculate Blood pressure, to monitor cardiac risk if any, by analyzing the obtained signals using various algorithms and thereby improve the health care in hospitals.

1. In this work, Electrocardiogram (ECG) and Peripheral Pulse (PPG) signals processing is done based on Discrete Wavelet Transform. As pulse transit time (PTT) is the time delay between R peak and the corresponding peak point of PPG, it is measured from these two points and blood pressure is estimated from this measured PTT. The SBP values measured by conventional mercury manometer and the values estimated by PTT technique are very closer and show only 2 to 5% variations.

2. Wavelet approach proved to be an efficient method for the R peak and peripheral pulse peak estimation and the pulse rate is accurately obtained from PPG peaks using Daubechies wavelet and found similar to Heart rate.

3. Also the heart rate and pulse rate are estimated from ECG and PPG signals. The heart rate and pulse rate measured by conventional bed side monitor and the estimated heart and pulse rate are nearly equal and shows only 2 to 5% variations.
4. The augmentation index calculated using the proposed method measures the degree of arterial stiffness by which cardiac risk to the patient has been predicted.

5. The proposed algorithm replaces the use of a special instrument in predicting cardiac risk and hence becomes cost effective and most efficient. It can be used along with the normal bed side patient monitor to continuously monitor the cardiac state of the patient.

6. The wavelet based ECG signals analysis done in this research work allows taking advantage of characteristics of both time-scale and frequency scale analysis.

7. The discretisation of ECG into P wave, QRS complex, ST segment and T waves is done using wavelet technique. And this application note has demonstrated that wavelet is a powerful tool in denoising, analysing, and extracting ECG signals easily and conveniently not only in heart illness diagnosis but also in ECG signal processing research.

8. Since the ECG signal of abnormal patients could not be collected, in this research part, from the available data, only characteristic features are obtained and presented.

9. From the ECG acquired from normal patients, P wave, QRS complex and T wave were extracted. For the extracted segments, characteristic features like amplitude and frequency were calculated. These values are found to be in good agreement with the standard values of the normal segments of ECG.
10. In addition to the above, additional works are being carried out in the area of ECG denoising. This is because, for long term monitoring of ECG the patient needs to be in the same position without movement. However this will not be possible in many cases. Hence the ECG signal will be corrupted with EMG noise. To set right this problem of disturbance of ECG signal and to allow the patients to move slightly during the measurements, attempts are being made to isolate ECG signal from the muscular artifact using wavelet technique and Empirical Mode Decomposition. The results of this will be useful for interpretation of ECG records even in the case of patient movements.

7.2 SCOPE FOR FUTURE RESEARCH

1. Since the application of wavelet transformation in electrocardiology is relatively new field of research, many methodological aspects (Choice of the mother wavelet and values of the scale parameters) of the wavelet technique will require further investigations in order to improve the clinical usefulness of this novel signal processing technique. Simultaneously diagnostic and prognostic significance of wavelet techniques in various fields of electrocardiology needs to be established in large clinical studies.

2. Future work needs to include more data analysis from patients to make the system more efficient.

3. Also studies can be done using PTT or ECG data alone to detect sleep apnea and respiratory activity.
4. Implementation of the algorithm can be planned in real time using Lab VIEW so that it can be used in hospitals for automated diagnosis which estimates blood pressure, heart rate, pulse rate etc. continuously and provide early warnings to major cardiac conditions, thus saving the cost of health care system significantly.