

ECG Motion Artefact Reduction Improvements of a Chest-based Wireless Patient Monitoring System

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Un-tethered patient monitors attract great interest in modern medicine. It affords patients earlier discharge, doctors increased flexibility and reduces hospital resource utilisation. With an aging population burdening healthcare services, such systems will become essential tools in overall healthcare operational strategies. However, ambulatory ECG monitoring causes motion artefact. Subsequent false positives and false negatives can effect patient management. This paper reports on a practical evaluation of motion artefact for a prototyped wireless body-worn monitoring device using multiple adult test subjects. For performance comparison, an FDA approved non-wireless system was employed and sensor leads restricted to minimise their movement. Both systems were worn concurrently, ensuring results were directly comparable. Evaluation of the device was undertaken for ranges of basic movements (bending, walking, sitting, climbing stairs) conducted under controlled conditions. This work is significant and timely as it highlights current progress in addressing key technical issues for successful implementation of smart cardiac monitors. Results indicate that the prototype system has greatly reduced motion artefact compared to the reference system. Reduction in artefact is achieved by strategic novel electrode design, optimised front-end interface and utilisation of wireless communications. In addition, heart rate and R-R intervals are of higher quality due to clearer ECG waveforms. Average heart rate difference between the prototype and the reference device is 3.8bpm with standard deviation of 12.4bpm. For R-R analysis, mean interval difference is 78.96ms with standard deviation of 123.1ms. In general, bending has highest differences due to considerable torso movement. More results for temperature, further R-R analysis etc. exist and are presented in the full paper. In conclusion, analysis of the quality of physiological data (ECG, heart rate, temperature and R-R interval) has shown the prototype system offers high fidelity recordings during basic movement. Also, due to on-chip data storage, it can be used for remote monitoring.