

# Multichannel ECG Recording from Waist using Textile Sensors

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## Abstract

**Background:** The development of wearable health monitoring systems is garnering substantial interest in research and technology due to their unique capabilities in continuous, real-time, and non-invasive tracking of the physiological states of the human body. Wearable devices provide insights into the performance and health of individuals. Despite recent advances in biosensors, most of the currently available wearable devices rely solely on a single sensor attached to the body, limiting the ability to obtain reliable bio-information. However, in engineering systems, sensor fusion, which is the optimal integration and processing of data from multiple sensors, has been a common theme. In recent years due to an increase in the availability and variety of different types of sensors, the possibility of achieving sensor fusion in wearable systems has become more attainable. Sensor fusion in multi-sensing systems results in a significant enhancement of information inference compared to that from systems with a sole sensor. One step towards the development of sensor fusion for wearable health monitoring systems is the accessibility to multiple reliable electrophysiological signals, which can be recorded continuously.

**Results:** In this paper, we develop a textile-based multi-channel ECG band that has the ability to measure from multiple locations on the waist. As a proof of concept, we show that ECG signals can be reliably obtained from different locations on the waist where the shape of the QRS complex is comparable with that recorded from the chest using traditional gel electrodes. As well, we develop a probabilistic approach to detect R-Peaks from noisy textile data in different sitting, standing, and jogging statuses. We show that the performance of the proposed algorithm is significantly better than that based on Pan-Tompkins and optimal-threshold methods.

**Conclusion:** This band can be easily integrated into garments such as underwear, bras or pants. We predict that the textile-based multi-channel ECG band can be considered as an effective wearable system which enables the development of sensor fusion methodology for pervasive and non-invasive health monitoring through continuous tracking of heart rate variability (HRV) from the waist.

## Full-text

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However, the manuscript can be downloaded and accessed as a PDF.