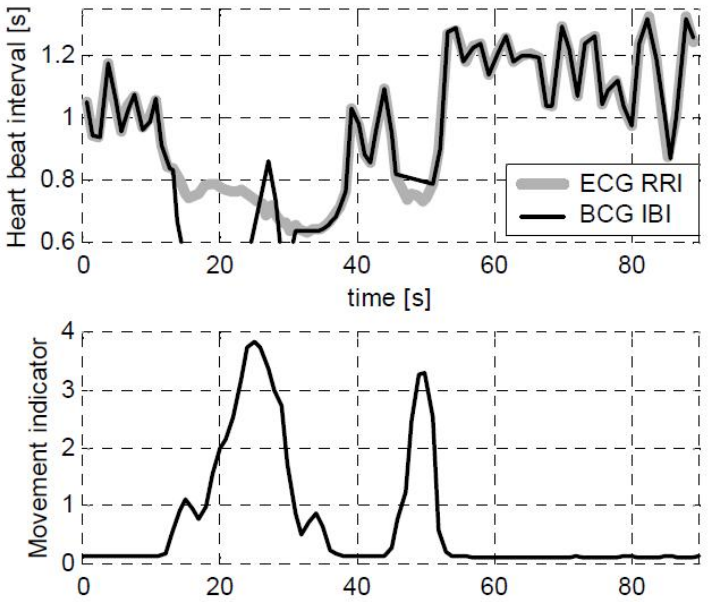
Business from technology



Low-cost Multi-channel Sensor Technology for Monitoring Heartbeat, Respiration and Activity in Furniture

Juha M. Kortelainen, Esko Strömmer
VTT Technical Research Centre of Finland

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Introduction

- During the last ten years, the interest in bringing the sleep analysis and the sleep disorder monitoring into home environment has increased remarkably. This concerns both its medical and private use. Earlier, the sleep analysis was practically possible only in special clinical environments with professional and expensive equipment.

- For sleep analysis in home environment, there are commercial single-channel non-contacting ballistocardiographic (BCG) bed sensors monitoring heartbeat, respiration and body movements. These are typically based on pressure sensing PVDF or EMFi film (e.g. Beddit sleep and wellness tracker). Typically these are single-channel type.

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- VTT has developed a multi-channel bed sensor prototype that has been validated with sleep laboratories, in which improvements due to the multichannel approach has been found for heart rate, respiration and sleep analysis. Most probably the benefits are even higher in more complex assembly in furniture, e.g. when measuring on a chair.

Research goals at VTT

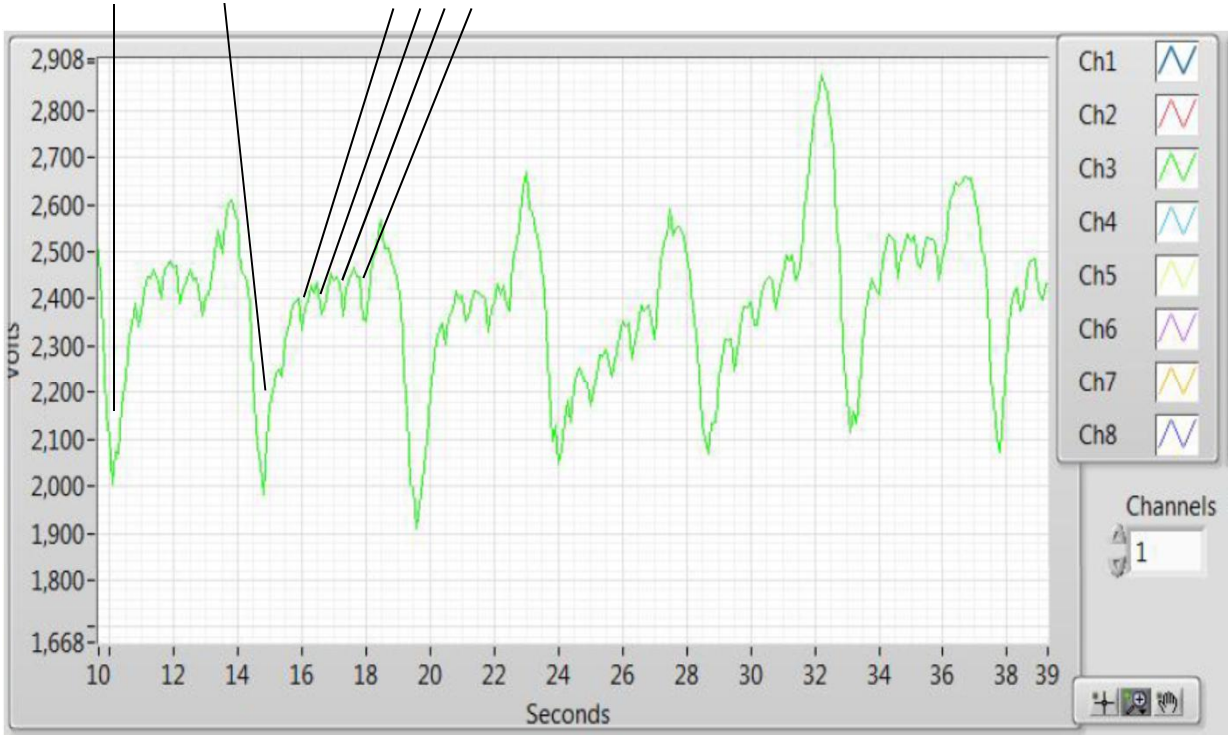
- To create and verify a technical implementation for a multi-channel sensor system for monitoring heartbeat, respiration, posture and activity in furniture.
- The multi-channel implementation has to improve the accuracy and reliability of the sensor system over the existing commercial single-channel bed sensors.
- The multi-channel implementation must not increase the price of the sensor system over the existing commercial single-channel bed sensors.
- The main components of the sensor system are:
  - Sensor film with integrated force sensor elements (e.g. 10 pcs.) to be placed into the furniture (e.g. below a mattress)
  - Multichannel sensor electronics for sensor signal conditioning and AD-conversion
  - Sensor signal processing
  - User and system interface

Current status of the research

- The multichannel signal processing algorithms have been developed and validated by sleep laboratories
- A low-cost sensor electronics has been designed and verified in laboratory environment. Output signal sample by a testee sitting on a single-channel sensor in a chair can be seen below

Response to respiration

Response to heartbeat



Next steps:

- Design and prototyping a low-cost sensor film by printable technologies
- Design, integration and verification of a complete sensor system

Multichannel BCG sensors, references

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