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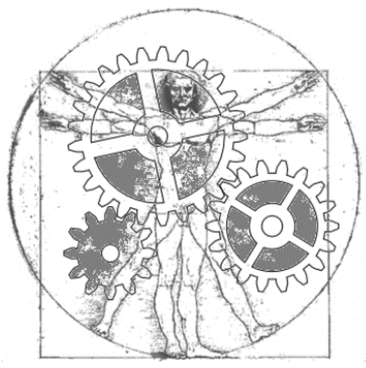
BodyPoweredSenSE RTD 2013

FNSNF



http://BodyPoweredSenSE.ch

Energy Aware Platform for Wearable Smart Medical Sensors

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ETH Zurich

ETH Zürich

Modeling of thermal energy harvesting under different conditions

- Variable behavior of ambient source energy results in different amount of energy available over time
- Modeling of energy harvesting provides the forecast of source availability and estimates the expected energy intake

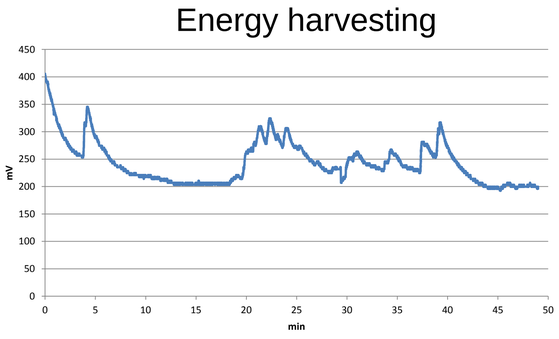
Thermal energy generators

Harvesting recording device

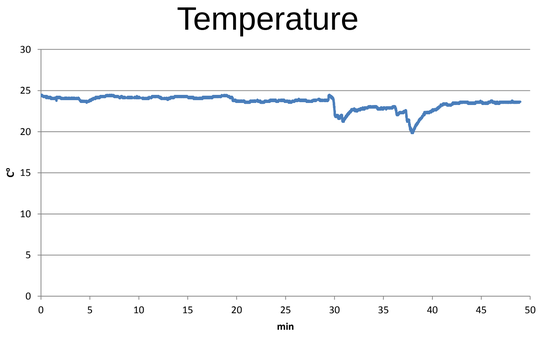
Child wearing TEG band doing everyday activities

- Evaluating differences between
  - Indoor, outdoor
  - Still, active
  - Elderly, children

Energy harvesting



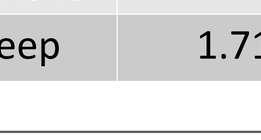
Temperature



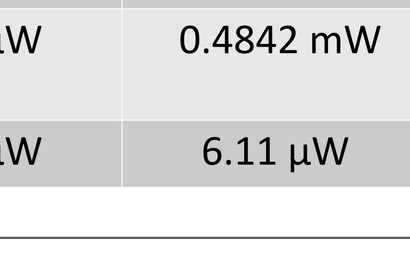
A Real-time QRS detection algorithm: Pan-Tompkins

- QRS complex detection based upon digital analysis of slope, amplitude and width
- Solar panel provides enough energy for substantial medical processing

Heartbeat detection device



Solar energy harvesting



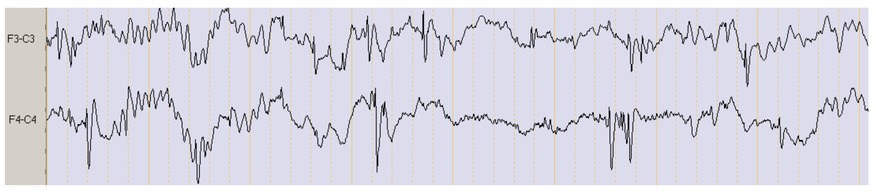
Band-pass filtered ECG signal

- Testing power management techniques of the platform by measuring power consumption of the implemented algorithm

Power consumption at 200 Hz	No function	Band-pass filter
No power management	8.59 mW	8.59 mW
Power management	6.55 µW	0.4842 mW
Deep sleep	1.71 µW	6.11 µW

Clinical algorithm development – EEG

- Analyze the computational complexity of different clinical algorithms for automated detection of epileptiform discharges:
  1. Wavelet analysis
  2. Matched filter



- Test the efficiency in detecting epileptiform activities in comparison with power consumed in completing the task

Wavelet analysis

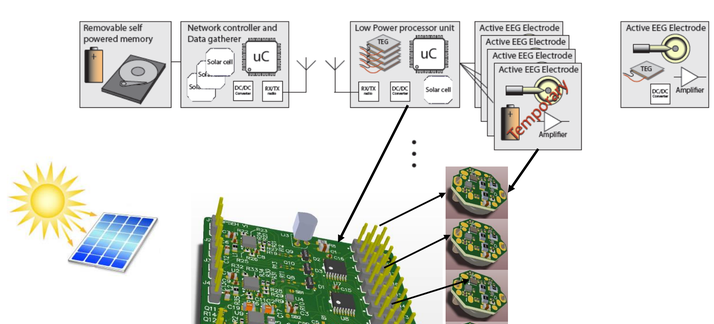
- Multi-resolutional analysis
- Advanced matching technique in spike detection

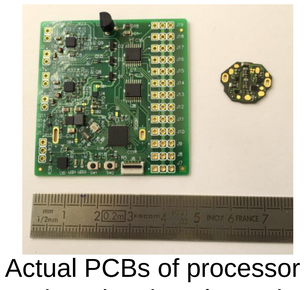
Matched filter

- Efficient method to detect specific patterns (events) in the signal

Demonstrator

- TEG and solar energy harvesting
- Modeling and prediction of energy harvesting
- EEG recording and seizure prediction using energy aware run time





Actual PCBs of processor unit and active electrode

- Five high speed and eight low speed analog electrodes for ECG or EEG recording
- One system for epilepsy monitoring and three systems for recording data for Alzheimer's disease