Thermoelectric Energy Harvesting for autonomous Body Sensor Networks

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BPS Project overview

Goal: Energy autonomous body sensor network

System: A portable system monitoring ECG, EEG
and the patient's environment (PEM)

Attributes: Unobtrusive, fit and forget, easy to use

Application: Long-term monitoring for the
• Diagnosis of absence epilepsy in children
• Early detection of Alzheimer's in elderly

Zero-power paradigm:
Energy harvesting instead of batteries

Seebeck effect: Direct conversion of heat into electricity

Evaluation of different generator types (simulation)

Thermoelectric generators (TEG)

Evaluation for BPS

Flexible: no

ConTEG: no

Integration with power conversion

Simulation of output characteristics

Advantages: Compact, robust, no moving parts, silent

Thermal harvesting from the human body

Heat flux through skin

Challenges for the application on the human body

• Small temperature differences → Generator optimization
• High thermal resistance of the skin → Optimized interfaces
• Low generator voltages → Integration with power conversion
• Dynamic power output → Integration with storage
• Human centered design → Size, weight, wearing comfort

Highlights

• Power generation in the mW regime from human body heat
• Compact systems that can be comfortably worn for several hours

Outlook

• Decreased size and weight while retaining output power
• Energy autonomous EEG electrodes with integrated thermoelectric harvesting

Findings and outlook

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