Energy Neutral Sensor System with Microscale Photovoltaic and Thermoelectric Energy Harvesting

Anand Savanth, Mathieu Bellanger, Alex Weddell, James Myers and Mathias Kauer

1 Motivation

- Energy neutral operation is desirable for long operation lifetime
- Minimum energy (MinE) operation if possible at ultra-low voltages
- Power conversion losses negate benefits of MinE systems

2 Design Choices

Conventional Scheme:
- PV harvester
- MPPT converter
- Storage
- Regulating converter

State-of-the-art Research:
- PV harvester
- Input Switch
- Bi-Dir converter
- Storage

Selective Direct Operation (SDO) exploits ultra-low operating voltage of MinE System to minimize discharge of energy storage device thus assist with energy-neutrality

3 Harvester-System Co-design

4 Measured Results

5 Conclusion

1. Photovoltaic and thermoelectric harvester characterisation scheme to aid with system co-design
2. Energy-neutral MinE system operation - 50 lux continuous or 200lux for 2hrs/day
3. Energy-neutral MinE system operation - ΔT = 20°C continuous or 50°C <1min/day
4. Energy neutral execution of sensor workloads with Selective Direct Operation


Email: anand.savanth@soton.ac.uk
IoT Research Showcase, 05 Apr 2019, Southampton