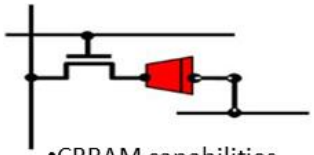
EnerHarv 2018
Inaugural International Energy Harvesting Workshop

adesto® TECHNOLOGIES

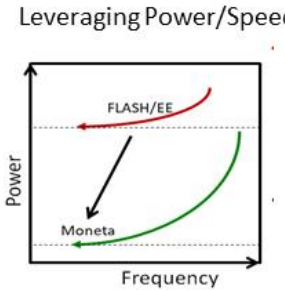
PSMA Power Sources Manufacturers Association The Multinational Power Electronics Association

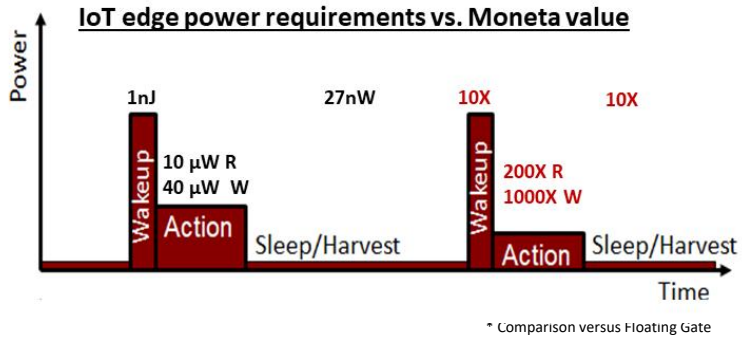
EnerHarv 2018 Workshop Demo Session:

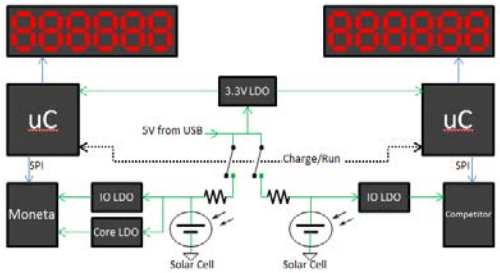
Moneta: Ultra Low Energy Non Volatile Memory



•CBRAM capabilities
- 1-3 V write
- 1 V read
- 10-100 ns write
- Bit alterability







Shane Hollmer, VP of Engineering, Adesto Technologies, shane.hollmer@adestotech.com

Tuesday, May 29, 2018

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SSIST

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EnerHarv 2018 Workshop Demo Session:

Wearable flexible thermoelectric generator using *liquid metal* interconnects and *bulk* BiTe legs

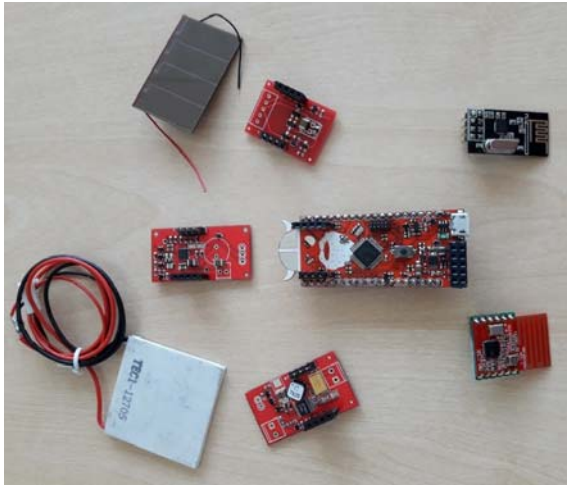
Mehmet C. Ozturk, Deputy Director
ASSIST Engineering Research Center, NC State University
mco@ncsu.edu

- Liquid metals enable self healing, stretchable interconnects with negligible contribution to the total device resistance
- No need to develop new thermoelectric materials – our devices incorporate materials used in rigid modules
- Fabrication is compatible with pick-and-place tooling

Tuesday, May 29, 2018

Implementing Energy Harvesting Solutions Using Commercial Off-the-shelf Components

Dusan Vuckovic, PhD, Senior Specialist Force Technology, duv@delta.dk



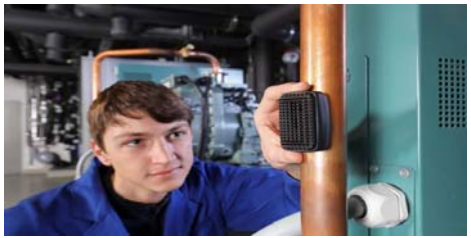
- **Modular platform for EH prototyping**
  - Support of multiple EH sources
  - Multiple EH power management modules
  - Support for multiple RF Technologies
  - Ultra low power main system controller board
  - Breadboard compatible
  - Standard 2.54mm headers for easy prototyping

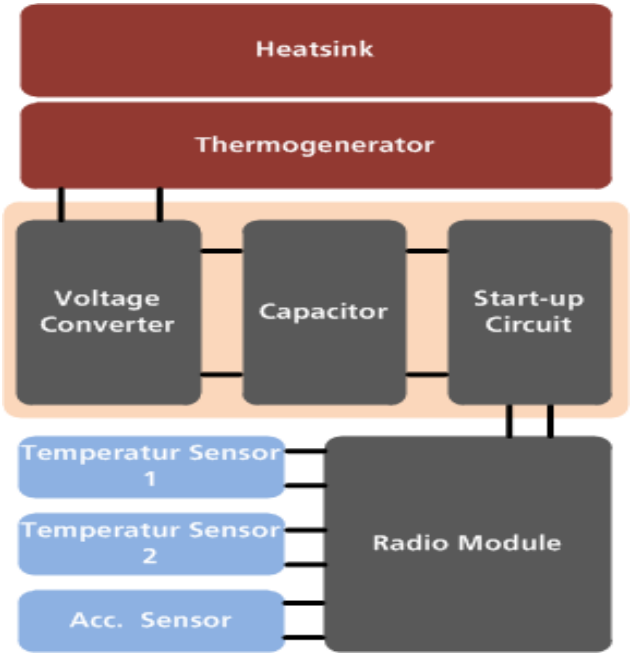
- **Bluetooth low energy demonstration**
  - Solar, Thermal and Mechanical harvester
  - Temperature measurement sent in advertising packets to an Android device

BlueTEG – Self-powered Wireless Sensor Platform

Peter Spies, Fraunhofer IIS

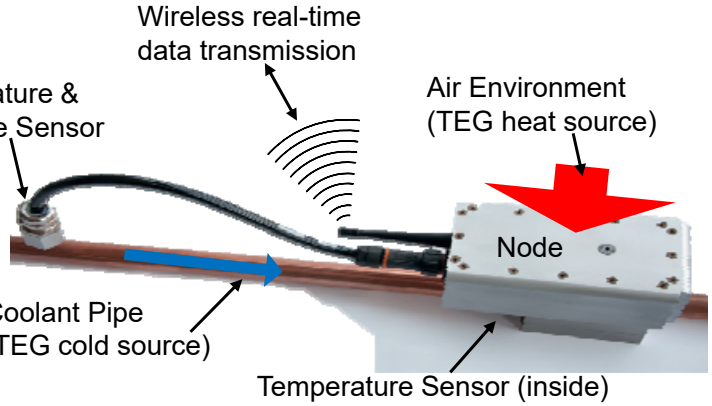
- Thermo-electrical power supply for BLE sensor
- High efficient voltage converters (flyback on CMOS IC) for ultra low input, bipolar voltages from commercial Bi_2Te_3 TEGs
- Several 100 µW in 36 cm^3 with 2 K thermal gradient (duty cycle BLE 1 sec)
- Applications: Industrial sensors, building automation, wearables





Demonstrator:
TEG powered Wireless Sensor System for Process Monitoring and Control

- Properties:
  - Self-sustaining operation supplied by a thermoelectric generator (TEG)
  - Battery-free operation from a few Kelvin of temperature difference
  - Wireless real-time data transmission with a large number of sensors
  - Demonstrator with pressure and temperature sensor
  - Flexible architecture, also suitable for other energy harvesting technologies and applications



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Dr. Philip Schmidt
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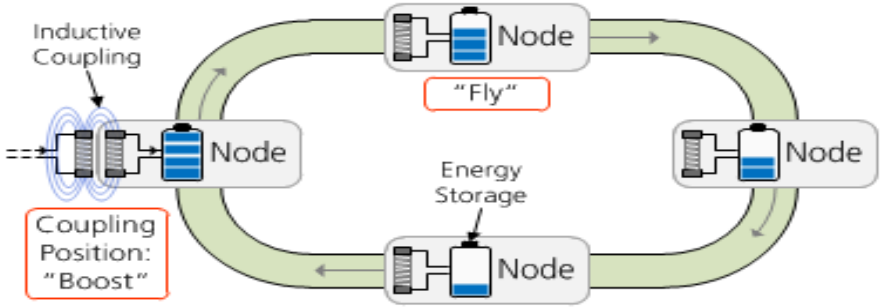
Demonstrator:
RF Powered Wireless Sensors for Industry 4.0

- Properties:
  - Self-sufficient operation of cyber-physical systems
  - Contactless inductive energy transmission at 125 kHz
  - “Boost”: charging time 2 seconds
    “Fly”: operation time up to 7 minutes
  - Real-time capable wireless interface based on “IO-Link Wireless” standard
    - 2.4 GHz ISM band (Frequency Hopping)
    - Cycle time: 12 ms



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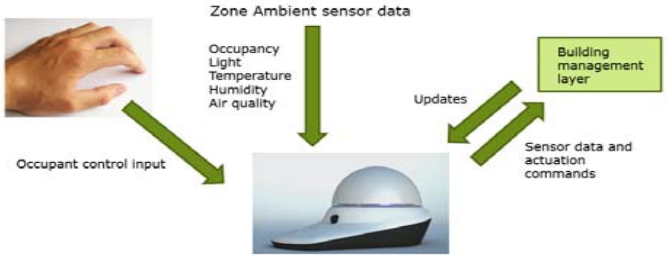
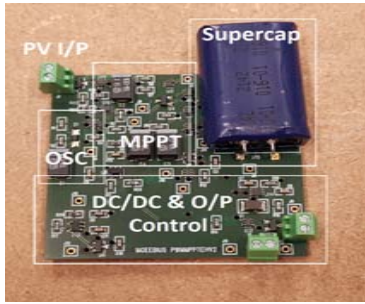
MOEEBIUS NOD using Energy Harvesting

- NOD is a custom multi modal wireless sensor
  - light, temperature, occupancy, humidity and air quality
- Data used to optimise lighting and heating for comfort and efficiency
- Display gives updated readings every 30 secs
- Indoor solar energy harvester solution is implemented to extend and in time replace the battery
- Demo is ‘battery free’ & runs short term on PV
- Working with NOD designers to reduce power consumption and offer long term operation





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COMPOSITION

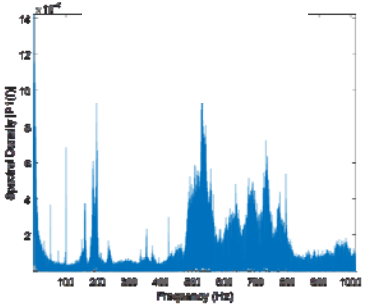
Boston Scientific
Advancing science for life™

EnerHarv 2018

Condition Monitoring for Industry 4.0

- Condition monitoring to enable predictive maintenance in manufacturing facilities yields a significant saving
  - Predictive fault detection of fans in a flow soldier oven can save up to €20K.
- The demo video will show how acoustic sensing enables predictive maintenance at Boston Scientific Ltd
- The next step is to enable Energy Harvested Condition monitoring by adopting low power embedded sensor techniques, enabling easily deployed, maintenance free sensing.

Faulty Fan Motor



Good Fan Motor