

Master Thesis:

# Micro-Energy Scavenging for Wireless Sensor Networks

Wireless sensor nodes are generally battery powered devices and consume very little energy. The wireless communication is traditionally considered the dominant contributor to the energy budget. However, for applications with high power sensors and/or high sampling rates such as encountered for high-accuracy GPS positioning [2] in the *X-Sense* [1] project, the ratio of power dissipation changes unfavorably, and the energy consumption of the sensor now dominates the overall power budget. Since these sensor nodes are expected to operate autonomously for multiple months to years, environmental energy scavenging has become inevitable.

For this thesis you will investigate the suitability of thermoelectric energy harvesting for recharging the battery of a wireless sensor node and so possibly enable perpetual operation. The basis of this work is a collaboration with a start-up company ([www.greenteg.com](http://www.greenteg.com)) specializing in the commercial development of Thermoelectric generators (TEGs). TEGs essentially generate electricity from temperature gradients (See Figure 1) by leveraging the Seebeck-effect. Your work will encompass familiarization with thermoelectric energy generation and its properties, as well as research of related work. You will further devise a development strategy and implement a functional thermoelectric harvesting prototype circuit.

**Requirements:** Mixture of HW/SW design skills.

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## Contacts

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## References

- [1] J. Beutel et al. X-Sense: Sensing in extreme environments. In *Design, Automation Test in Europe Conference Exhibition (DATE), 2011*, pages 1–6, March 2011.
- [2] B. Buchli, F. Sutton, and J. Beutel. Gps-equipped wireless sensor network node for high-accuracy positioning applications. In *Proc. of 9th European Conference on Wireless Sensor Networks (EWSN 2012)*, pages 179–195, Trento, Italy, 2012. Springer.
- [3] F. Frick. Thermo-power. In *Bild der Wissenschaft*, 2012.

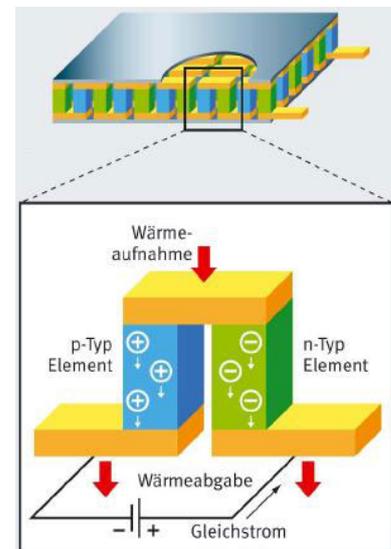


Figure 1: Principle of TEG operation [3]