Bachelor Thesis

« Temperature Modeling of Energy Buffers for Wireless Sensor Nodes »

Background

Energy is the most limiting factor for the lifetime of nodes in wireless sensor networks. To create a self-sustaining system, generating energy from the environment using energy harvesters is a suitable solution. Harvested energy is usually stored in an energy buffer. Among a sufficient buffer capacity, the durability and temperature stability are of highest importance to create a long-time stable energy supply. Many wireless sensor network operate outdoors and suffer from severe temperature fluctuations. Despite its aging influence on energy buffers, temperature also influences the self-discharge or the maximum current. For example most lithium based accumulators supply less current at low temperatures and cannot be charged at all below 0 °C.

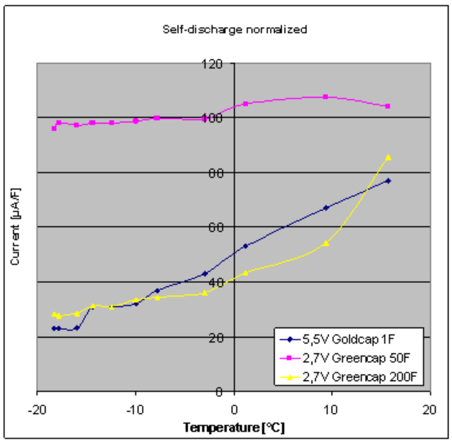
Work Description

Aim and objectives of this thesis are to analyze the temperature dependency and create a temperature model for different energy buffer technologies. The model aims to predict available buffer energy and therefore improve lifetime-predictions for wireless sensor nodes. Suitable energy buffers among the following already available types are chosen:

- Supercapacitors
- NiMH / NiCd
- Lithium based, e.g. lithium-ion polymer, lithium iron phosphate, Thinergy MicroEnergyCell

Each technology is tested under controlled conditions in a climate chamber which features a temperature range of -40 °C to 180 °C. For the development of the temperature model measurements are analyzed to determine the influence of temperature on energy buffer characteristics such as:

- Capacity
- Self-discharge
- Maximum output current
- Maximum charge current
- Aging effects



Contact: Juergen Jessen

juergen.jessen@tu-harburg.de Phone: +49 40 / 428 78 – 3745 Room: E 4.073