ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

TIK
Institut für Technische Informatik
und Kommunikationsnetze
Computer Engineering and
Networks Laboratory

Prof. L. Thiele

Semester / Master Thesis:

Energy Management for Low Power Harvesting Scenarios

Motivation Energy harvesting is generally seen to be the key to power cyber-physical systems in a low-cost, long term, efficient manner. However, harvesting has traditionally been coupled with large energy storage devices to mitigate the effects of the source's variability. The emerging class of transiently powered systems avoids this issue by performing computation only as a function of the harvested energy, minimizing the expensive and obtrusive storage element. Thanks to an Energy Management Unit (EMU), the source's power/voltage can be decoupled from its load, enabling each to work independently at their optimal point.

Your Project Your main task in this thesis is to improve the current Energy Management Unit. This can be by adding logic to the EMU (e.g. ultra low power microcontroller) that can adapt the burst generation scheme to changing environmental conditions. Another possibility is to have a bank of capacitors, with different timing properties which are optimized to individual applications. Under certain environmental conditions, switching capacitors can improve the system's behavior. You will need to validate you approach experimentally, using relevant metrics such as energy efficiency. Depending on time and motivation, an improved version of our Solar EMU can be designed and tested with your proposed improvements.

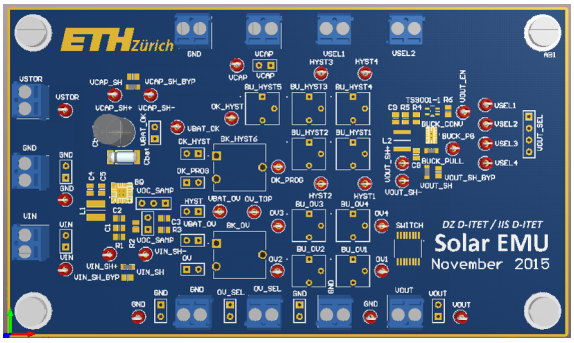

Figure 1: Energy Management for Solar (PV) Harvesting

Requirements: You should be highly motivated, have experience with embedded system programming in C, and be comfortable working with lab equipment such as oscilloscopes and logic analyzers. PCB design experience is an advantage.

Interested? Please have a look at `http://www.tec.ethz.ch/research.html` and contact us for more details!

Contacts

- Andres Gomez: `gomeza@tik.ee.ethz.ch`, ETZ J68.2
- Lukas Sigrist: `lukas.sigrist@tik.ee.ethz.ch`, ETZ G78.1

References

[1] Dynamic Energy Burst Scaling for Transiently Powered Systems. Gomez, A. et al. To appear, DATE 2016.

[2] Tragedy of the Coulombs: Federating Energy Storage for Tiny, Intermittently-Powered Sensors. Hester, J. et al. SenSys 2015