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 Thesis:

Ultra-Low Power Wake-up Circuit for Acoustic Sensing

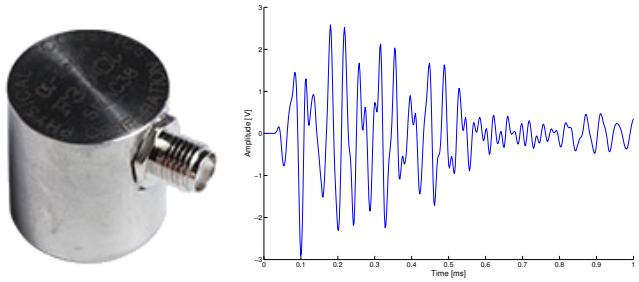

Figure 1: Acoustic emission sensor with an example of its analog output signal.

Motivation and Informal Description:

We have built a prototype wireless acoustic emission sensing platform [1] for the monitoring of alpine rock walls [2]. Since the device is battery-powered, its energy efficiency is of paramount importance. The aim of this semester thesis is to improve the energy efficiency of the prototype without adversely impacting the characterization of the acoustic events as sensed by the acoustic emission sensor (see Figure 1).

The current prototype continuously samples an acoustic emission sensor using an analog to digital converter. An attached microcontroller characterizes the sensed acoustic event, and communicates the event to a remote base station using a wireless sensor node. Instead of continuously processing digital samples in the microcontroller, it is proposed to employ an ultra-low power wake-up circuit (see [3] for details on how this could be achieved) that wakes-up the microcontroller from a low-power sleep mode only when an acoustic event is detected. Figure 2 illustrates the proposed system architecture.

Your project: For this semester thesis, you will first design and simulate an ultra-low power analog circuit for detecting the presence of an audio signal by comparing the input signal with a programmable threshold. After evaluating this circuit, you will construct a prototype and interface it to a wireless sensor node. Finally, you will evaluate the overall performance and power dissipation of your implementation.

Requirements: You should have experience with Matlab and a circuit simulation package (e.g. LTspice), be able to design and construct electronic circuits (e.g. using Altium), have some experience with embedded C programming, and have an interest in working in the lab with instruments.

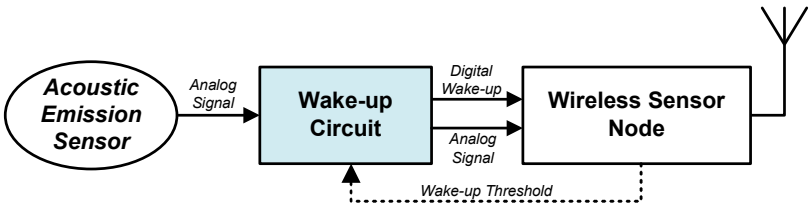

Figure 2: Proposed system architecture.

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

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References:

[1] Acoustic Emission Sensing in Wireless Sensor Networks, J. Hunziker, et. al., ETH Master Thesis, 2011.
[2] A Custom Acoustic Emission Monitoring System for Harsh Environments: Application to Freezing-induced Damage in Alpine Rock Walls, L. Girard, et. al., Geoscientific Instrumentation, Methods and Data, 2012.
[3] CargoNet: A Low-Cost MicroPower Sensor Node Exploiting Quasi-Passive Wakeup for Adaptive Asynchronous Monitoring of Exceptional Events, M. Malinowski, et. al, SenSys 2007.