TRAINING BROCHURE

Ultra low power for Internet of Things training

Provisional reservation

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high tech institute

Ultra low power for Internet of Things

Price: € 1,190 excl. VAT *

Duration: 4 online afternoon sessions

Contact: training@hightechinstitute.nl, +31 85 401 3600

Score: 7.6 ★★★☆☆

Intro

Energy consumption has become a primary design constraint, along with performance and clock frequency:

- A multitude of devices are connected through the Internet (Internet of Things - IoT);
- Many IoT devices communicate wirelessly and run on batteries;
- European laws become stricter about energy.

We need to use much less energy.
This workshop shows that the energy consumption can be reduced drastically provided we work on a systematic and holistic way.

Energy consumption is a system issue with many consumption influencing factors. A gain on one place can create a loss on another place. It is a matter of balancing and making compromises.

Lower energy consumption only can be achieved by proper design at all levels of abstraction: from architectural design to component selection and physical implementation, but also through careful use and control of the operating system and careful design of application programs. Power management and functionality are interwoven and ask for a real time control.

This workshop gives a broad and systematic overview of the overwhelming possibilities for ultra low power design. More experienced people can also benefit from this course because of the overview and the many hints and tips.

Various hardware blocks are discussed from the perspective of their possibility to consume less power: MCU's, memory/processor/I-O, sensors & interfacing, radio, energy sources, regulators. Reduction possibilities are discussed on various levels:

- Guidelines for MCU selection;
- System architecture: balance between the location of data processing and data transport, distribution of activities in the pipeline of an IoT system;
- Balance between performance and energy consumption;
- Effects of compiler and linker settings;
- Software mapping onto memory modules dependent on their speed and consumption and on time critical routines (e.g. analysis of the effect of alignment);
- Instruments (hardware tooling, benchmarks) are used to measure the energy consumption before and after the introduced changes.

The lecturer (advanced expert at Capgemini Engineering) has a broad and in-depth hardware-software engineering experience (in research and development, feasibility studies, system performance tuning), has acted a lot on the border between hardware and software and is an advisor of the

Certification

Participants will receive a High Tech Institute course certificate, based on workshop exercises.

Course leader

Hans Vink MSc

Trainers

Herman Roebbers MSEE

** Prices are subject to change. Price correction will be applied at the end of the year.*

Keep me posted

EEMBC Working Groups ULPMark, IoTMark-BLE and SecureMark-TLS. (EEMBC defines Industry-Standard Benchmarks for Embedded Systems). He was part of the ULP group at Holst Center for 2 years. He is also (co-)author of several papers in the area of parallel programming using the Communicating Sequential Processes paradigm and the use of Analytical Software Design / Dezyne. He regularly gives guest lectures at universities, polytechnics and at various conferences, defines graduation projects and coaches students.

The 'Ultra Low Power' workshop:

- Identifies factors that influence energy consumption;
- Shows how to model and measure energy consumption;
- Provides an overview of available energy measurement tooling;
- Provides an overview of how to reduce the energy footprint;
- Gives a guideline for MCU selection;
- Gives a design process use case on how to investigate and apply the energy reduction techniques in a systematic way;
- Provides hands-on sessions to anchor the obtained knowledge.

Objective

After completion of this course the participant will:

- Understand that power management is a system issue;
- Have guidelines for MCU selection;
- Know modern energy-efficient architectures;
- Understand the hardware features to reduce the energy footprint;
- Understand available tooling for energy measurement;
- Have hands-on experience working with starter kits for energy measurement;
- Know how to identify critical system parameters;
- Have insight into the possibilities and restrictions of a successful implementation of low power targets in embedded systems;
- Know a systematic process for applying power management.

Intended for

The course is intended for IoT developers, software and hardware engineers involved in embedded software design, system architects, project leaders (education: BSc / MSc) working in research, development and/or engineering. Prior knowledge: working experience with a PC with Windows, ability to read simple C programs.

Program

Day 1

- Power management is a system issue;
- Static vs. dynamic power consumption;
- Hands-on 1: energy profiling, energy modes, measure energy consumption;
- Techniques for reduction of energy consumption;
- Available tools for energy measurement;
- Hands-on 2: reduce power consumption using DMA;
- Energy harvesting, storage and retrieval;
- How much energy do my peripherals consume?

Day 2

- Guideline for MCU selection;
- Architectural approaches to reducing energy consumption;
- Hands-on 3: energy profiling, knowledge on peripheral, power and clock states;
- Influence of HW architecture on optimization opportunities;
- Energy-efficient coding guidelines;
- IoT radio technologies and energy consumption;
- Hands-on 4: evaluation of coding influence on energy;
- Benchmarking using EEMC ULP benchmark, demonstration;
- Use case on how to investigate and apply the energy reduction techniques in a systematic way
- Hands-on 5: energy benchmarking (with EEMBC ULPMark).

Methods

Methods: Lectures, demonstrations, hands-on sessions.

The course has been adapted such that it can be organized online. The attendees are requested to buy some electronics (hardware and software, approximately € 135,-) to be connected to and installed onto a laptop. With these components the attendees can attend the hands-on sessions individually and guided by the lecturer. After the course the attendees can keep using the components.

Read the interview:

Remarks from participants:

- 'Interesting overview of all the components that influence consumption in a system.' > Iker Reyes , Imec NL
- ‘Very interesting and broad, recommendable to many people.’ > Elias Vanderstuyft – Sioux Embedded Systems