

Theme : Next Generation Computing

Subject : Ultra-Low Power Computing Platform for Wearable IoT Devices

Introduction

The goal of this research subject is to explore novel ultra-low power computing platform for the wearable IoT (Internet of Things) devices at the edge of the network. The wearable IoT devices are composed of sensors, wireless communication modules, and possibly actuators, where each needs to be energy-efficiently coordinated by embedded microprocessors. The role of local computing platform including microprocessor is likely to gain more of its attentions as IoT devices proliferate. Explosion of network traffics and delay will apparently become practical issues for providing timely services, therefore demands for local data processing capabilities such as sensor noise filtration and compression may increase.

To drive wearable IoT devices under power deficient circumstances, careful power-aware design in multiple layers should be considered. The design layers may include processor architecture, sub-memory systems, software stacks, power management methods using hints possibly given by resource utilization patterns. In addition, taking energy harvesting technology into account in the computing platform design is highly desirable.

Scope

Challenges of overcoming power deficient situation of wearable IoT devices by ultra-low power design:

- Concepts and methods for ultra-low power IoT computing platform (Proc. Arch., S/W, PMU, and etc.)
- Low-power data proc. algorithm (Noise iteration, Data Compression, and etc.) and comm. protocol
- Concepts and methods for an efficient integration with energy harvesting devices
- Concepts and methods for hint-aware power saving (e.g, hints contain the information of internal sensors, the usage of wireless connectivity, and the communication with nearby devices, etc.)

Research questions

We are interested in the following research questions. These questions are not exhaustive but different research questions are open to discuss with research partners.

- What would be the critical factor for designing ultra-low power IoT computing platform?
- What would be the most important computing function that wearable IoT devices need to support in order to provide differentiated services? (Based on application-specific scenario)
- Is it possible to design useful ultra-low power wearable IoT computing platform that can be driven wholly based on energy harvesting? If so, what needs to be technically addressed?

Expected Deliverables

The following is open to discussion:

- Design documents of new concepts and/or design of ultra-low power IoT computing platform with technical details and S/W source code (if available)
- Prototype samples (if available)
- Patents with Samsung (if agreed)
- Detailed quarterly progress reports summarizing accomplishments
- Joint publication in the international conferences and journals with Samsung Electronics (if agreed)