A Holistic Approach to Power Management for Energy Harvesting Embedded Systems

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***Abstract*—We present a holistic approach to maximizing the energy efficiency of energy harvesting embedded systems which consist of a processor system and an energy harvesting system. A power management program integrated on a real-time OS optimally switches operation mode of the processor and configuration of the energy harvesting system according to the workload of the processor and harvesting situation. The demonstration will show that our prototype system consisting of our processor chip and harvesting system board stably runs using harvested energy only.**

The processor has multiple cores having a different performance in each to improve the energy efficiency of computation. The energy harvesting board has high transferring efficiency to reduce the power loss. The entire system is controlled efficiently by our power management program implemented on Toppers OS.

A. *Entire System Management*

We use Toppers kernel as OS for our system. The OS checks the status of the energy situation in the energy harvesting board, and determines the processor operation. Fig. 1 shows the management diagram in our system.

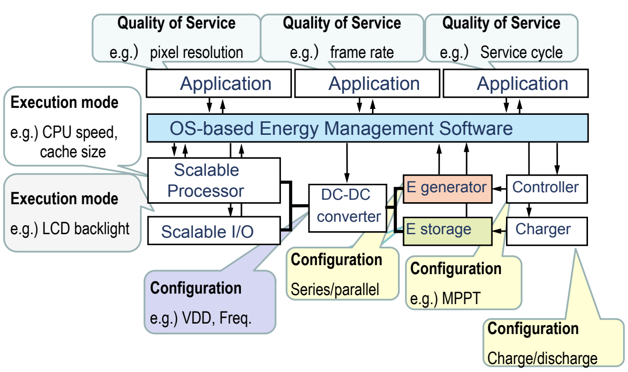


Fig. 1. OS-based energy management.

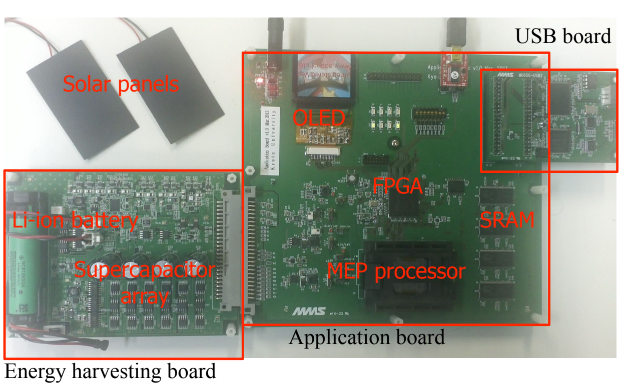
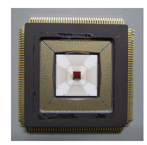


Fig. 2. The prototype system with solar panels.

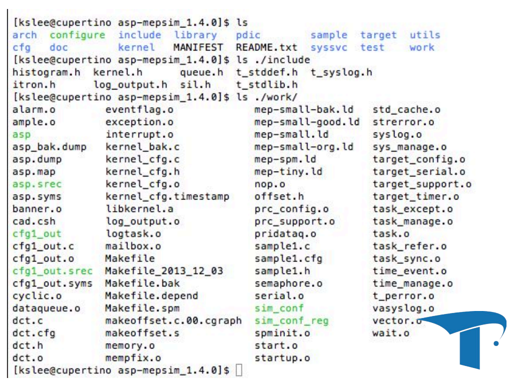
The prototype board (Fig. 2) operation will be demonstrated. The processor power and control circuits (FPGA) are supplied by the energy harvesting devices. We use Li-ion battery and supercapacitors as an energy storage for the system. The circuits for the demonstration such as SRAM, LED, USB or OLED are powered by another external supplier because of its high power consumption.

B. *Demonstation Key items*

1. Energy Harvesting Board and Application Board (Fig. 2)
2. Dual Core Mep Processor (1.2V and 0.8V cores)



3. Toppers Kernel (http://www.toppers.jp/en)



4. Monitoring System with DAQ