Application-level Prediction of Battery Dissipation

Objective:

An investigation into the degree to which battery dissipation induced by program execution can be measured by application-level software tools and predicted by a compiler and runtime system.A novel technique is presented with which we can accurately estimate whole-program power-consumption for an arbitrary program by composing battery dissipation rates of benchmarks.

Device Used:: iPAQ

Technique:

- The method relies on application-level observations of *battery dissipation* for a representative set of benchmarks when running on the entire device (and not any subsystem in isolation). It is then shown how these benchmark dissipation rates can be combined to form an estimate for any arbitrary program.
- The relevant set of instruction categories that are necesary to make accurate battery dissipaton estimates for the iPAQ are identified.
- Demonstrates the way in which benchmark readings for these categories can be *composed* into a dissipation estimate for a target program and it also details the accuracy of these estimates by comparing them to observed dissipation values for a set of target application programs.
- They construct a complete battery dissipation curve for the target application, compute the rate of drain for an arbitrary program directly from the rate of drain of the benchmarks that implement the constituent instruction types of the programs.
- Four general categories of relevant instruction types were identified as the integer(IReg) and floating point(FPReg) register operations and integer(IMem) and floating point (FPMem) loads and stores.
- The *composition* of the benchmarks for an arbitrary application is done by considering the time spent executing in each of the aforementioned benchmark categories.
- Later, various computation algorithms were executed and the battery drain curves wrt to the percentages of the mentioned categories are drawn.

Results:

- For integer algorithms, it is observed that the IReg-IMem predicted curves are nearly indistinguishable from the observed curve for all benchmarks.
- For floating point algorithms, when FPReg was included in the composition, the resulting predicted curve is very much similar to the observed ones.