

Statistical Analysis of Mobile Device Power Consumption

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Abstract

Mobile devices (mobile phone, smartphone, web tablet, PDA) has become a part of everyday life. Typically, the battery is the only energy source of the stand-alone device. All the architectural components and processes consume battery power. For example, a camera, a display or a network module are most energy-consuming.

Designers of mobile devices are constantly coming up with various technologies to reduce power consumption. Many companies (Nokia, Samsung and others) use in their devices light sensors, which regulate the display backlight. In addition, proper design of the user interface allows user to reduce power consumption. Another way to save battery power is reducing energy consumption at the physical level. In particular, mobile devices have special architectural components with understated power.

In this work we analyze the energy consumption at the application level. The purposes of our work are to monitor the battery charge in a view to estimate the remaining time to full battery discharge.

The investigated device was chosen Nokia N900 which runs under operating system Maemo 5 on the Linux kernel. Therefore measurements of energy consumption was conveniently carried out using a special script in python that run in daemon mode. The script is regularly recording the measurement results to a log file. We have received eleven log files wich contain more than 30 thousand records. Each record presents the value of the battery level. The workload on the device has been variated, each log file corresponds to the period from full charge to full discharge. After processing the results we have obtained empirical distribution function for amount of energy spent per time unit.

Also using Qt framework we have developed a prototype for futher analysis of the energy consumption. The prototype provides detailed information on the amount of energy spent by each running process and could be started automatically. We have developed several modules. These are module for measuring the battery level, module for the monitoring of processes energy consumption, module for recording observation data in the file. These modules are managed by the main module that works in daemon mode. All these modules are responsible for collecting data.

The future plan suppose further statistical analysis and mathematical modelling of the energy consumption process. On this basis, it will be possible to provide estimation of predicted remaining work time based on probabalistic approach.