

Wearable and Ubiquitous Computing, Spring 2005
Homework #2
Assigned 3/1. Due 3/15.

1. Suppose the energy capacity of a battery is given by $(1 - 0.5x)$ Wh, where x is the load power in Watts and $0 \leq x \leq 2$. Assume the nominal energy capacity of the battery is 1 Wh. The system running off of this battery spends 20% of its time in active mode at power $P_{\text{active}}=0.4\text{W}$, and 80% of its time in idle mode at power $P_{\text{idle}}=0.1\text{W}$.

a) Estimate the battery life of the system using both the first and second order equations for battery life given in class.

b) Suppose you have the choice between reducing P_{active} from 0.4W to 0.2W or reducing P_{idle} from 0.1W to 0.05W. Which is better using the first order equation for battery life? Which is better using the second order equation? Show your work.

2. Dr. Opie T. Miser has claimed a tremendous breakthrough in power management that will give an order of magnitude improvement in battery life: His new method reduces the average power consumption of a wireless network card from 1.3W to 0.1W.

a) How much will his breakthrough improve the battery life of a notebook computer with an average power consumption of 15W? A PDA with an average power consumption of 2.5W? Both of these average power consumption figures include the 1.3W of the network card.

b) What do you think of Dr. Miser's claim about improving battery life?

c) In general, if a subsystem's power consumption is P_{sub} , the total system power consumption P_{total} , and the subsystem's power is reduced by a factor of X , what is the improvement in battery life? Assume the battery is ideal, i.e. provides a constant amount of energy no matter what the load power is.