Assignment for COMP4336/9336 Mobile Data Networking
Semester 2, 2015 (Individual Assignment)

Due: 11:59pm Friday 23 October

Weighting: 25%

Preliminary Version – Released on 22 July 2015

NOTE: This is a preliminary version released in the *orientation week* (Week 0) to help students understand the assignment tasks involved from the very beginning. Some details, such as the submission procedure, assessment guideline, etc., as well as some other minor tasks will be included in the final version to be released in Week 3. Students are encouraged to read this version carefully and bring any matters of concern or confusion to the lecturer within the first the two weeks of the semester, so they can be addressed in the final version. All assignment related matters should be discussed using the Discussion Forum on the Moodle account of this course.

Title: Analysing Energy Consumption and Harvesting for Mobile Devices

Purpose

Limited battery energy is a major issue for mobile devices. An increasing array of new features and applications, which demand even more power, is creating the situation more challenging. Energy harvesting (EH) is currently being researched as a viable solution to combat the power supply issue for a range of wireless devices. Broadly, EH refers to harvesting ambient energy from the environment to supply power to the wireless device. The purpose of this assignment is to analyse energy consumption of various activities we perform with our personal mobile devices and assess the potentials for energy harvesting using two most readily available sources of energy, *kinetic* and *radio frequency* (RF).

Platform

Students are allowed to use any Android or iOS devices of their choice for this assignment.

Learning objectives

Upon completing this assignment, students will:

1. Gain a deep insight to energy consumption and energy harvesting for mobile devices,
2. Learn how to design and execute experiments for collecting sensor traces relevant for energy harvesting analysis,
3. Be able to analyse energy harvesting opportunity from sensor traces,
4. Develop skills to think critically and be creative in designing practical experiments involving mobile devices
5. Apply their knowledge and skills learned in lectures and laboratory sessions to study a new cutting-edge problem with significant practical relevance

Assignment Tasks

Task 1 – Measuring Energy Consumption

In this task, you will measure energy consumption using the "battery drain" method, i.e., by monitoring the descent of battery *charge level*.

Measure energy consumption for **five different activities**, including the following two:

(a) Using Accelerometer: Run the accelerometer continuously and measure battery energy consumption. Show sample graphs of battery charge level and report energy consumption for accelerometers for 3 different sampling rates. Based on your data, conclude about the impact of sampling rate on accelerometer energy consumption.

(b) Using GPS: Turn on GPS and measure battery energy consumption. Show sample graphs of battery charge level.

Repeat energy consumption experiments for **three more activities** of your choice. Then compare energy consumption of these 5 different activities and provide possible explanations for why certain activities consume less or more energy than others.

Task 2 – Kinetic Energy Harvesting

In this task, you will use acceleration data to estimate the potential for kinetic energy harvesting for different human activities using the models discussed in the lecture.

Perform the following tasks

(a) Collect accelerometer data for **four different human activities**, including walking and jogging. Choose **two more activities** of your choice. Show sample graphs of acceleration data for all these activities and discuss any differences.

(b) Convert accelerometer data to power using the different models explained in the lecture. Show sample graphs of power generation from four different activities. Compare different models for estimating power from accelerometer and discuss (suggest possible explanations) any differences you find between these two models. Compare the power generating potential for different activities and discuss (suggest possible explanations) any differences you find between them.

Task 3 – RF Energy Harvesting

In this task, you will use WiFi RSS data to estimate the potential for RF energy harvesting for different locations.

You are required to complete the following tasks:

(a) Visit three different shopping malls and collect WiFi RSS data. Show sample graphs of WiFi RSS data. Using this data, estimate RF energy harvesting potential for shopping malls.

(b) Collect Uniwide RSS at different locations at UNSW (use GPS or NETWORK location manager to identify location). Show sample graphs of WiFi RSS data. Estimate and discuss RF energy harvesting potential at UNSW for Uniwide WiFi service.

(c) Repeat the last experiment for another (other than Uniwide) WiFi signal and discuss how Uniwide would perform against that WiFi in terms of energy harvesting.

(d) Repeat the last experiment, but this time you will measure your home WiFi RSS. Measure RSS at three different distances, 1m, 3m, and 5m, from the home wireless router. Discuss and explain the differences in energy harvesting as a function of distance from the WiFi router.