Microsoft Research does Cloud-Offloaded GPS

December 25 2012, by Nancy Owano

Overall results from 6 locations. The shadow is 100m in diameter. Credit: Microsoft Research

(Phys.org)—GPS reduces battery life in a smartphone or tablet, a problem that has challenged a team led by principal researcher Jie Liu at Microsoft Research. Liu has said in the past that sensing and energy are emerging cross-cutting concerns in computer systems. "The proliferation of embedded and personal devices such as networked sensors and mobile phones gives computer systems increasing capability of gathering data from and adapting to the physical world and personal activities."

At the same time, energy constraints at different scales can affect battery life "and thus user experiences in embedded devices, and can be a limiting factor for the growth of IT infrastructure," he said.

How to serve up sensing data and at the same time reduce resource consumption has become a research task for Liu and co-workers. His group conducts fundamental and systems research on sensing and energy-efficient computing.

Addressing the GPS battery drain, Microsoft Research is using a concept for location services that involves offloading some of the data and calculations to consume far less power.

They have offloaded some of the work to the cloud. Their GPS system collects only a few milliseconds of information from satellites. The information is combined with information from public, online databases to calculate the device's past locations.

"We built an experimental platform using WWVB [the station used by radio-controlled clocks in North America to synchronize themselves] time synchronization and a GPS front end," according to the team. "On this platform, sensing a GPS location takes more than three orders of magnitude less energy than GPS on mobile phones," they stated. They moved to offload some of the work to the cloud, naming their platform, CLEO (Cultivating the Long tail in Environmental Observations).

"Typical GPS receivers, although widely available, consume too much energy to be useful for many applications. Observing that in many sensing scenarios, the location information can be post-processed when the data is uploaded to a server, we design a Cloud-Offloaded GPS (CO-GPS) solution that allows a sensing device to aggressively duty-cycle its GPS receiver and log just enough raw GPS signal for postprocessing."

They said that by leveraging publicly available information such as GNSS satellite ephemeris and an Earth elevation database, a cloud service can derive good-quality GPS locations from a few milliseconds of raw data.

They presented their research in Toronto at the ACM Conference on Embedded Networked Sensor Systems (SenSys). Their paper was titled "Energy Efficient GPS Sensing with Cloud Offloading," by Jie Liu, Bodhi Priyantha, Ted Hart, Heitor Ramos, Antonio A.F. Loureiro, and Qiang Wang. Their study was awarded Best Paper at the conference.

They said the reference platform consists of a GPS receiver (Maxim MAX2769), a microcontroller (TI MCUMSP430F5338), a WWVB receiver module for time synchronization, and a serial flash chip for storage and glue logic. In addition, the platform has a solar cell, a thin-film Micro-Energy cell battery, and a Hi-Jack inspired audio communication port. An 8Mbit flash enables storing up to 1000 GPS sample points. "The goal of the design is to demonstrate the low energy consumption per GPS sample."

More information: Research paper (PDF)