Community Health Maps

Information on Low Cost Mapping Tools for Community-based Organizations

How Accurate is the GPS on my Smart Phone? (Part 2)

In Part 1, I introduced the three parts of the hybrid locational system used by tablets and smart phones. Now I'll discuss each individually.

Assisted-GPS (A-GPS)

A-GPS is by far the most accurate of the three systems on your phone. A-GPS operates a little differently than the typical handheld GPS receiver. The assistance is provided by the cellular network. When connected to a cellular network the smart phone will download data about the GPS satellite constellation. This allows the phone to lock in on a position much more quickly than it could otherwise. The GPS functionality of a smart phone can still be used if the cellular network is unavailable. However, when disconnected from a network your phone will take several minutes to hone in on your location, versus just seconds when the network is available.

The A-GPS receivers on iPhones have steadily improved from the iPhone 3 to the iPhone 5. In addition to the U.S. DOD GPS system, the Russians have a satellite navigation system called GLONASS. The newest smart phones (e.g., iPhone 4S and iPhone 5) now have GPS chips that use both satellite systems giving increased accuracy! Europe, India and China are also developing satellite navigation systems and in the not too distant future GPS receivers may be able to use several systems simultaneously and become even more accurate.

WiFi and Network Positioning

For any GPS to work the antennae needs a clear view of the sky. Users of smart phones will frequently be in "urban canyons" or indoors. This is where WiFi and cellular network positioning become necessary. Both of these methods are used by smart phones as ***indoor positioning***

systems. The phone will use a hybrid approach, using all three methods to locate you. These other two technologies aren't nearly as accurate as A-GPS, but can still locate you sufficiently to find the closest vanilla latte!

Generally WiFi positioning is more accurate than cellular network positioning. It uses wireless access points and measures the intensity of the received signal from one or more networks to find the position. Interestingly it doesn't require your device to be WiFi enabled to work.

Cellular network positioning triangulates your position based off of nearby cell phone towers. Phone companies have precise locations for their cell towers, which when combined with signal strength can be used to approximate your location. Both of these techniques are dependent on overlapping signals from either access points and cellular towers. Therefore they're more accurate in urban settings.

So What's It All Mean?

From numerous tests the typical GPS receiver will achieve an accuracy of 1-5 meters. Unfortunately assisted-GPS accuracies have not been studied nearly as thoroughly as typical GPS receivers. The best studies to date are those by Dr. Paul Zandbergen at the University of New Mexico. In 2009 he published findings showing that an iPhone 3 had an average accuracy of 8 meters. In that study the error never exceeded 30 meters. Below are the results of his 2009 study including all three locational systems.

- 3G iPhone w/ A-GPS ~ 8 meters
- 3G iPhone w/ wifi ~ 74 meters
- 3G iPhone w/ Cellular positioning ~ 600 meters

Numerous anecdotal studies indicate that the iPhone 4S/5 has become more accurate. In 2011 Dr. Zandbergen tested several Android smart phones. Here he found the accuracies to be slightly better than the 2009 study. They ranged from 5-8 meters. It is likely that the iPhone 4S/5 is within this range as well. It can also be assumed that iPads and other Android tablets will be comparable.

Other Options for Increasing Accuracy

There are several third party external GPS receivers that connect to the smart phone via Bluetooth. For example, the Dual 150S can be used to increase accuracy in more remote locations. It can be worn like a wrist watch, placed on a car dash or strapped to a backpack. It will provide 2.5 meter accuracy and only costs $100.

Dual 150S External GPS Receiver

Summary

If getting within 5-8 meters meets your data requirements smart phones and tablets are a great way to go. If you need greater accuracy you can combine an external Bluetooth GPS receiver with your device and get that accuracy down to the 2-3 meter range. If you require more accuracy than that you will need to invest in a mapping grade GPS receiver.

This entry was posted in Data Collection and tagged GPS, GPS accuracy, mobile mapping, public health, smartphone, tablet on July 7, 2014 [https://communityhealthmaps.nlm.nih.gov/2014/07/07/how-accurate-is-the-gps-on-my-smart-phone-part-2/] .