

Geographic Fieldwork: Preliminary Study Comparing GPS Capabilities Between Smartphones and Dedicated GPS

Anna Klimaszewski-Patterson



Why bother?

★ Dedicated GPS devices can be expensive

★ Need for cost-effective alternative for students and researchers

★ Smartphones are quickly becoming fixtures in everyday lives

★ 45% adults, 66% 18-29 (09/2012 – Pew Research)

★ 20% ownership (10/2010 - CNN)

★ Can smartphones be used as a reliable GPS device?



Devices Used

HTC G1 Dream

2.2 x 4.6 x 0.7 inches

192 MiB RAM
256 MiB ROM
528 Mhz Processor
3.2" Display
Multi-touch Screen

GPS Protocol
NMEA 0183

Reported Accuracy
3-6 meters

Released Oct 2008

Resale (eBay)
~\$90 unlocked



Trimble Juno SB

2.9 x 5.1 x 1.2 inches

128 MiB RAM
128 MiB ROM
533 Mhz Processor
3.5" Display
Touchscreen

GPS Protocol
NMEA 0183, SIRF

Reported Accuracy
2-5 meters
1-3 m. post-process

Released Dec 2008

Resale (eBay)
\$1,750 (~\$10)



Applications Used

HTC G1 Dream

Maverick
(Free or \$5)

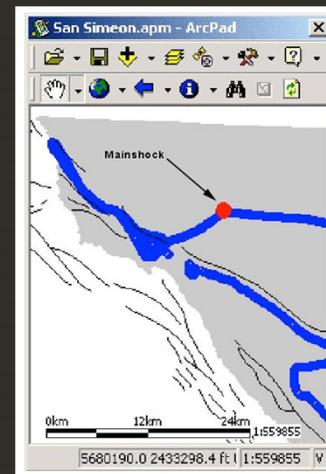


OruxMaps
(Free)

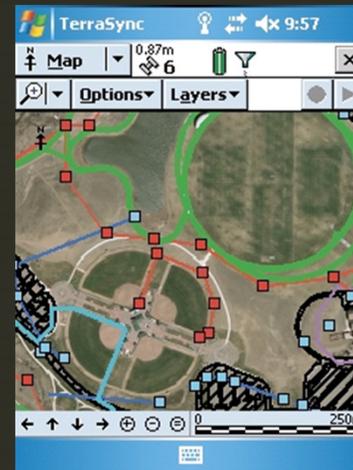


Trimble Juno SB

ArcPad 8
(\$700)
+ GPS
Correct
(+\$495)



TerraSync
Standard
(\$295)



Tests Performed

★ User Experience

★ Accuracy Assessment



User Experience

★ Surveyed 3 students at New Mexico State University

★ Geography students (2 graduate, 1 undergraduate senior)

★ All technologically inclined

★ All working towards a minor in GIS

★ All have considerable experience with ArcGIS



User Experience Tests

★ Record, read, navigate, and load

- ★ Specific geographic coordinates (waypoints)

- ★ Polylines (tracks)

- ★ Polygons

★ Export collected data

- ★ Google Earth

- ★ ArcGIS 9.3.1



User Experience Results

★ G1's applications

- ★ Most preferred for all three tasks
- ★ More intuitive and thoughtful user interfaces

★ Juno applications

- ★ Participants were frustrated, especially ArcPad, and would refuse to make anymore untrained attempts
- ★ After training, participants thought both Juno applications were more difficult than necessary



Accuracy Assessment

- ★ Used a 1992 survey of control points created by Bohannon-Huston for the City of Las Cruces, NM
- ★ Randomly selected points until 5% (13) of points were found to still exist (54% failure rate)
- ★ Repeatedly visited the 13 selected control points between Feb and Mar 2010
- ★ 37 total samples per device/application (Dev/App)

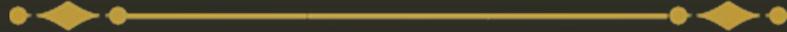


Data Recorded

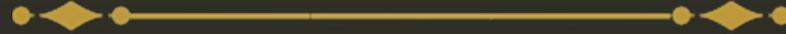
- ★ Position (Latitude, Longitude)
- ★ Reported accuracy
 - ★ aka: Estimated Positional Error (EPE)
- ★ Number of satellites (locked/seen)
- ★ Positional Dilution of Precision (PDOP)



1000100100100101
1010100101010100
101010101010
10101010
1010101010101010
10111010
101010101010001010
000000101000111
0001011111001010
111001010101000
101010111
010101010100011
001011110
1100000
0000101010111
01001111010100
10110101
001011010101101111
010011110010100
10101101101111
111101010100
1101010101
0000101010101111111
001011110101010
11110101010000000



Station Visualization



Accuracy Results

Dev/App	Min. Reported Accuracy (EPE)	Max. Reported Accuracy (EPE)	Average EPE	Avg. PDOP
G1/OruxMaps	2 meters	6 meters	3.3 meters	N/A
G1/Maverick	2 meters	6 meters	3.3 meters	N/A
Juno/ArcPad	5 meters	9 meters	6.0 meters	1.52
Juno/TerraSync	5 meters	8.3 meters	5.8 meters	2.61

Dev/App	Points within EPE	Points within EPE +1 meter	Avg. EPE Residual Error
G1/OruxMaps	87%	100%	-0.98 meters
G1/Maverick	87%	100%	-1.1 meters
Juno/ArcPad	95%	100%	-3.3 meters
Juno/TerraSync	90%	92%	-2.7 meters



Overall Conclusions

- ★ G1 was found to be more precise in its reported EPE vs. actual accuracy
- ★ G1 applications were more user friendly
- ★ G1 applications do not (yet) have the robust enterprise-level capabilities of ArcPad or TerraSync
 - ★ This could easily change in the future
- ★ G1 appears to be a cost-effective, viable GPS alternative to more expensive stand-alone GPS devices



References

Toolkit

Klimaszewski-Patterson, A. 2010. Convert GPS files (KML, GPX, WPT, PLT) to shapefiles (GPSFiles to SHP toolbox). *ArcGIS Resource Center: Geoprocessing Model and Script Tool Gallery*. <http://resources.arcgis.com/gallery/file/geoprocessing/details?entryID=BC061D5E-1422-2418-7FCE-CC0FBB0C0825>. Accessed August 30, 2010.

Article

Klimaszewski-Patterson, A. 2010. Smartphones in the field: Preliminary study comparing GPS capabilities between a smartphone and dedicated GPS device. *Papers of the Applied Geography Conference* 33: 270-279. http://www.academia.edu/353833/Geographic_Fieldwork_Preliminary_study_comparing_GPS_capabilities_between_smartphones_and_dedicated_GPS



1000100100100101
1010100101010100
10101010101010
10101010
101010101001010
10111010
101010101010001010
000000101000111
0001011111001010
111001010101000
101010111
010101010100011
001011110
1100000
0000101010111
01001111010100
10110101
0010110101011111
010011110010100
10101101101111
111101010100
1101010101
000010101010111111
001011110101010
11110101010000000

Thank you

Please contact me at eradani@gmail.com
with any questions



Extra

- ✦ In case you were interested, here's a link to the military testing smartphones for deployment using GPS and mobile network functionality

<http://www.youtube.com/watch?v=cuGcFmpYXBk>

