

Handheld LiDAR TECHNOLOGIES

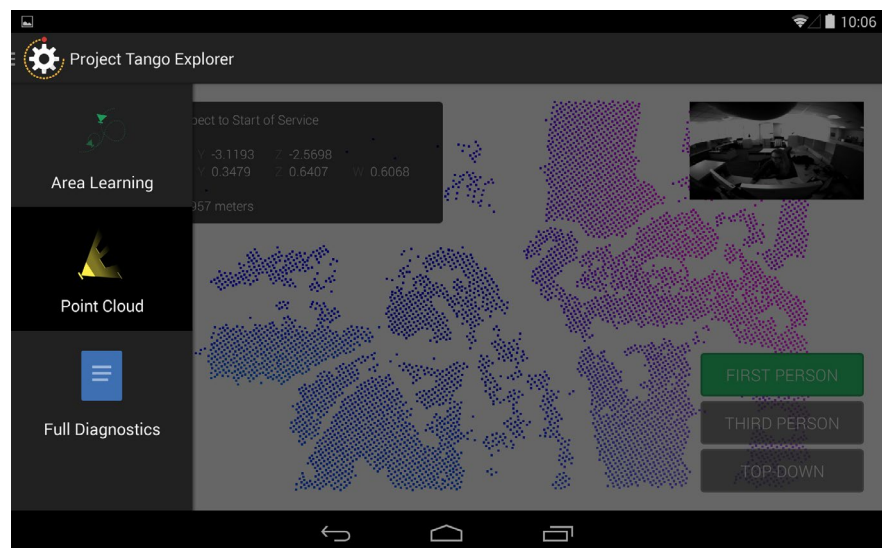
There have been several innovations in LiDAR technology over the last ten years. The profession has seen many improvements in hardware providing much faster repetition rates and better positional accuracies from the POS systems. The software has improved dramatically as well and provides innovative solutions for our clients. Hardware and software improvements continue to drive new solutions for clients and provide new markets in the LiDAR profession. The recent release of the [Project Tango](#) development kit from Google and [Spike](#) from IckeGPS provide even more potential for LiDAR providers to move into new market spaces at much lower cost.

There is much buzz about the potential for Google's Project Tango in many markets and one of those markets is the mapping profession. The initial release of this program was about a year ago and Google accepted proposals from developers for 200 of these development kits to developers for free. It was extremely hard to get one because the demand was so great. In the early part of December 2014, Google released a follow up development kit

for \$1024 to those individuals that did not get selected for the initial release. If you did not get selected for the initial release you had to sign up for the second release and they gave these individuals 7 days to order during this release. If any development kits remain, additional development kits will be made available.

The development kit comes as a Google tablet with a 7.02" 1920 1200

HD IPS display (323 ppi) and weighting 0.82 LBS. The OS is Android 4.4 Kitkat®. It does come with 4G LTE (no SIM included) and the tablet functions without 4G LTE, Dual-band Wi-Fi (2.4Ghz/5Ghz) WiFi 802.11 a/b/g/n and NFC (reader and peer to peer modes). The memory is 128GB and 4GB RAM but there is a Micro SD slot for additional memory. There is an USB 3.0 host



The Project Tango Explorer displaying captured points and concurrent IR camera displayed real-time.

BY JAMES WILDER YOUNG



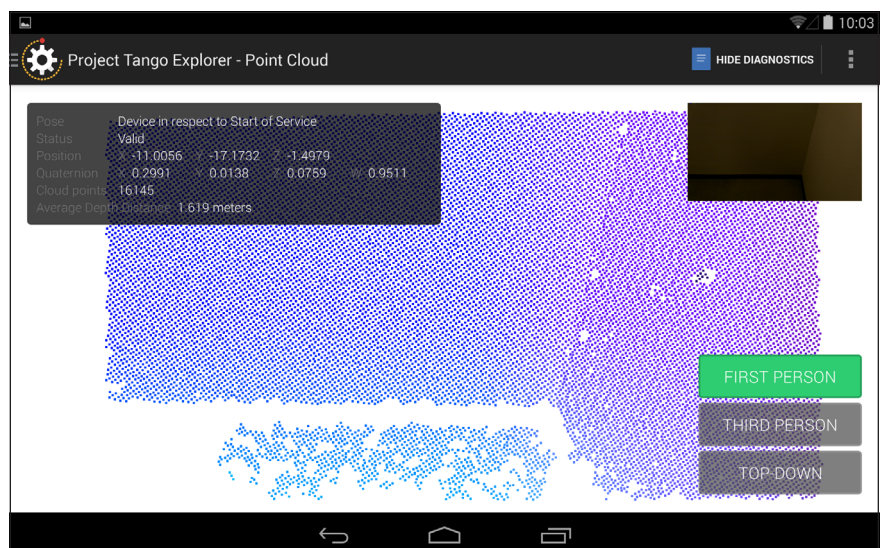
Merrick employee operating the Project Tango Tablet with Spike attached to it. Inset lower left; Spike device attached to smart phone, Inset lower right; Project Tango tablet

it takes about 1 hour to do everything required. Google cautioned and rightfully so that this is a development kit and there will be updates required over time and a Project Tango debugging app was available for download. Additionally, The Project Tango SDK (software development kit) files and APK (application packages) files are available on the site for download. Google notes on their site that the SDK is under active development and there may be issues with it but that should be understand as this is a development kit. The APK which installs the system level service for Project Tango capabilities are accessible via C and Java APIs as also indicated on the developer's site. The demo site provides additional apps to explore as they relate to the Project Tango Development program.

There seems to be much potential for Project Tango and how it could be used. There are few applications as they relate to the mapping professional. Initial thoughts from the short time spent with the device would indicate that there is

via dock connector and the processor is a NVIDIA Tegra K1 w/ 192 CUDA cores. The tablet is Bluetooth compatible and the audio includes dual stereo speakers and 3.5mm audio connector (OMTP standard). The tablet includes motion tracking camera, 3-D depth sensing, accelerometer, ambient light, barometer, compass, GPS and gyroscope. The laser is a class 1 laser product. The cameras included are a 4 MP 2nm RGB-IR pixel sensor and a 1MP front facing, fixed focus. This Google tablet is basically a nicer tablet on steroids.

There are several steps to get the tablet set up to use as a development kit but there is no problems doing this and



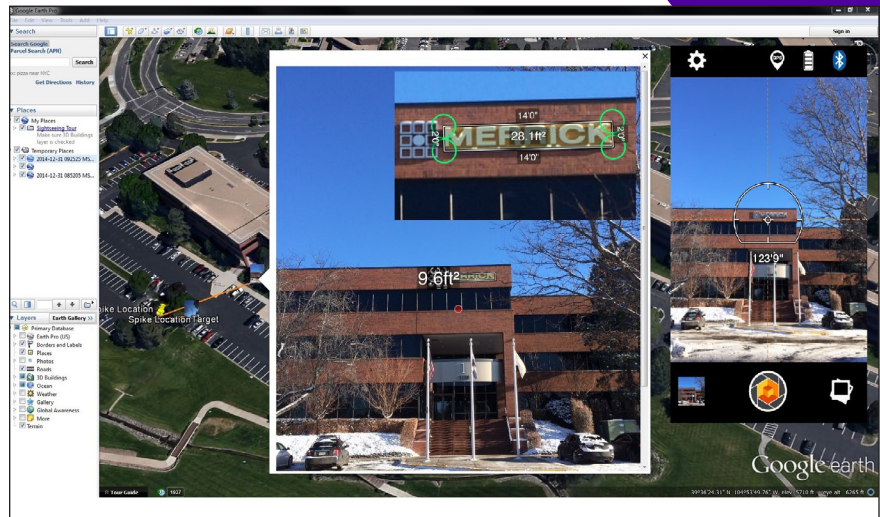
The Project Tango Explorer displaying captured points and RGB image of a stairwell, real time.

much potential in BIM mapping and other micro level mapping exercises, but as the technology advances there will be additional potential. Google did caution that the system works better indoors and based on the limited time with the development kit there is much to learn about its functionality and what can be developed from it.

When doing a quick search for apps for Project Tango as they might relate to the mapping profession, two relevant apps were located. Additionally, Trimble is currently working on [SketchUp Scan](#) and Through the Wall apps which look like they will provide very good functionality.

The two apps found on the Google site that are most interesting to use right after configuring the system are the Project Tango Explorer app. Information about that app and its functionality can be located on the Google developer's site by doing a Google search by app name. Another app which was downloaded and provided viewing of point cloud information is located with the Project Tango apps, and is called "thoughtthelookinglass" by Kris Kitchen. This app appears with title "Depth" on the tablet after installation. Both apps provide a good interface to what the tablet is capturing real time. Point clouds, imagery and statistical information are displayed while capturing information with both apps.

There is much more to come from Project Tango and the surface has only been barely scratched at the time this



Spike output displayed in KMZ format, enlarged location output with close up of sign measurements and area calculations in the center and the spike display and range measurement on the right.

article was written. There is much to explore, as it relates to the point clouds, imagery, and statistical information being generated from Project Tango and the potential and how it relates to the LiDAR and mapping profession. One thing is for sure, Google has done an excellent job preparing for the release of the developer's kit and more than enough developer information, programming reference and apps are available to help a developer get started on configuring and developing other applications for this device.

The Spike from IkeGPS was released about 3-4 months ago and cost about \$660.00 pre-order. The Spike interfaces with smart phones and tablets. Connecting and operating the Spike is extremely simple. The connection uses the Bluetooth® interface. The Spike works with both Android and iOS on both smart phones and tablets. Basically, the Spike is a laser range finder that through software utilizes the smart phones or tablets camera and GPS. It takes this

information and allows the user to make simple and somewhat complex measurements than saves them in PDF, XML(Spike format) or KMZ format.


The website indicates "Spike is the world's first laser accurate Smartphone measurement solution. The Spike device, Spike mobile app, and your Smartphone work together to change the way measurements are taken and shared....". The Spike I received works pretty well for what it is intended for and I have used it on the iPhone, iPad Air and the Project Tango Tablet. IkeGPS indicated that a SDK will be available with the release of the sensor but now its release is expected in spring 2015. There are many applications for this device and I believe the SDK will provide much additional functionality and potential for the mapping profession and other professions as well.

It is important to calibrate the Spike to make sure it is ranging correctly to get the most accurate measurement. The Spike can range to distances up to 650

feet. Calibration is very simple and takes little time. Initial testing of the Spike yielded measurements within 0.5" in all directions, but once it was calibrated vertical measurements were right on and horizontal measurements are within 1/8", which appear to be better than they state. Use caution because these test were done from 15' to 75' and it is my guess that the accuracy might be less from farther distances.

The measuring is done by using the touch pad of your device and moving your finger to the locations of which you are measuring. This concerned me at first but a magnification window appears so you can move and locate the cursor right where you need to. The Spike also gives the user the ability to zoom, as with most smart phones and tablets. The functions on the display after a picture is taken are align, area, cutout and line. When the picture is taken, the align function is default. This function is for measuring polygons. Area measures and calculated the area of a given polygon. Cutout allows the user to measure additional polygons within the scene. The line function draws and measures the distance of lines within the scene. All of the information is saved to the scene and downloadable in the formats indicated above. The information saved is editable using programs familiar with the formats. Overall, this device also has potential in the mapping profession and I am sure that there are several other colleagues developing interesting solutions with this device.

Date Time: December 31, 2014 at 9:00:49 AM MST



Measurement Data

Main Measurement	
Area:	No main

Main Measurement - Cutouts	
Total Area:	0.0ft ²

Line Measurement	
No lines	

Alignment Measurement

Width:	1'11"
Height:	12"
Area:	2.2ft ²

Cutout Measurement

No Cutout	
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Location Data

Phone Location	
Latitude:	39.606652°
Longitude:	-104.898539°
Altitude:	5663'0"

Target Location	
Latitude:	39.606656°
Longitude:	-104.898397°
Altitude:	5685'10"

Sensor Data

Distance:	46'1"
True Bearing:	88.0°
Pitch:	29.7°
Roll:	2.1°



PDF output from the Spike system including saved image and information stored from the calculations and measurements

Project Tango and Spike are only two new technology devices that have been recently released for use and development, there are others currently out there that will add additional potential in the market. These two devices show much potential to improve what can be done and add additional capabilities in

solving client's problems while providing solutions within the LiDAR and mapping profession. ■

Jamie Young is Senior Geospatial Technologist for Merrick & Company in Denver, Colorado. He has twenty years of experience in remote sensing including 18 years in LiDAR. He has worked with all types and phases of LiDAR.