Ridge measurement on road curb

MOBILE MAPPING TO CREATE AUTONOMOUS VEHICLE MAPS IN SINGAPORE

WITH THE RISING OF RESEARCH AND DEVELOPMENT ON AUTONOMOUS VEHICLES, A DETAILED AND PRECISE MAP FOR THE VEHICLE IS REQUIRED. GPS LANDS SINGAPORE TOOK ON AN INITIATIVE TO PRODUCE A HIGHLY DETAILED MAP FOR AN AUTONOMOUS VEHICLE TESTING AREA IN SINGAPORE USING 3D MOBILE MAPPING SYSTEM TO COLLECT THE DATA AND PERFORM FEATURE EXTRACTION USING THE 3D DATA.

Introduction

In Singapore's quest to be a Smart Nation - https://www.smartnation. sg/what-is-smart-nation/initiatives/ Transport/autonomous-vehicles - one of the core pillars for this initiative is the development and implementation of self-driving technology by putting Autonomous Vehicles (AV) on the roads. This is in part to revolutionise and transform our transportation system and to improve our living environment.

Since January 2015, Singapore's Land Transport Authority (LTA) - https://www. lta.gov.sg/, in partnership with Jurong Town Corporation (JTC) - https://www. jtc.gov.sg/, has designated One-North, a tech hub located in the western part of Singapore, as the first AV test-bed in Singapore. This test bed provides 55km of routes with various possible scenarios to support robust tests of AVs.

AVs that passes the safety test are able to submit application to allow on-road testing in the designated area of public roads. Since then, the development of AVs has been rapid and there are already 14 AVs registered for public road trials and even in some tourist spots like Gardens by the Bay and Sentosa Island resort. Tourist will be able to take a ride in these AVs while touring these places of interest.

With the increased awareness and a global push to move into all things robotics and dynamic platforms to be autonomously guided, the demand for safety and high accuracy information is on the rise. GPS Lands Singapore took on the initiative to produce highly detailed maps for AV
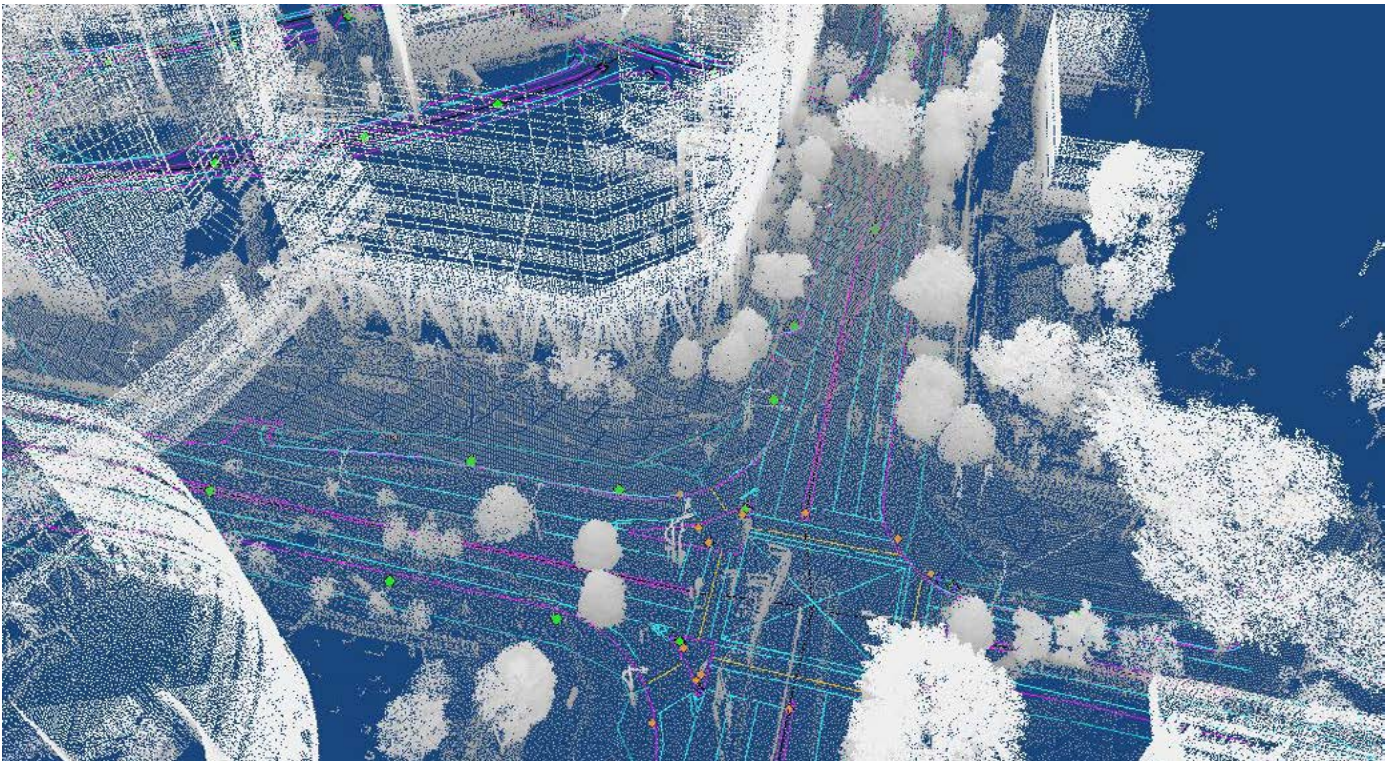
Extracted features 3D view

trial areas in Singapore in order to support the Smart Nation initiative. A highly detailed map can support AV development in terms of localization and simulation and these information are critical also to the safety aspects by travelling in the correct direction and slowing down or stopping on traffic junctions, pedestrian crossings and a whole host of potential scenarios that an AV needs to "function" safely and efficiently.

Data capturing

GPS Lands Singapore deployed a Mobile Laser Scanning (MLS) system to capture the roads & surrounding elements of the autonomous vehicle testing site. The accuracy of the trajectory and the resulting pointcloud relies heavily on correct mission planning. Satellite coverage, structural conditions and the size of the project area need to be considered before deploying the system.

Satellite images or street photographs help to get a first impression of the mission site. Commonly known and free available tools can be employed

for this purpose. Detailed planning of the route to be followed during data acquisition helps the driver and operator team in the field to fulfill their tasks. Route objects are imported into the acquisition software and are used to aid the team's navigation during the capture process.

Road features extraction

After the data has been captured and processed, the pointcloud data is then imported into Orbit's 3DM Feature Extraction Pro for extraction of road features. Using the 3DM Feature Extraction Pro allows semi-automated extraction of road features such as lane markings and curb lines, using the automatic detection of traffic signs and poles helps in identifying the location of all the traffic signs and traffic light poles where the operator is able to extract all the accepted detections.

The update in the hover display tool to detect ridges greatly assisted the accurate extraction of curb lines as it assist in finding the lower curb edges and with a single click, the curb line is extracted easily.

Action review

The whole exercise took about 4 months to start from mission planning to completion of extraction. There are still challenges in extraction of way points and the road links needs to be created manually to identify the direction and also the linked roads at a road junction where the AV is allow to turn into. The reviewing of the auto-detection tools also took some time to filter out the false detections but in return, it reduces the time required to manually search for the features in the data.

After the completion of the first AV map that GPS Lands Singapore created as an initial trial to showcase the strength of Orbit GT's solutions in this fast growing space globally, the next plan would be to provide potential map providers or even AV companies Orbit GT technologies for them to extract and create their own AV map data to meet their unique needs.

ABOUT THE AUTHOR

Eric Low is the Project Manager for GPS Lands (Singapore) with 10 years of experience working in the land survey industry. He was formally from Singapore Land Authority (Land Survey Department) and has good working knowledge with laser sca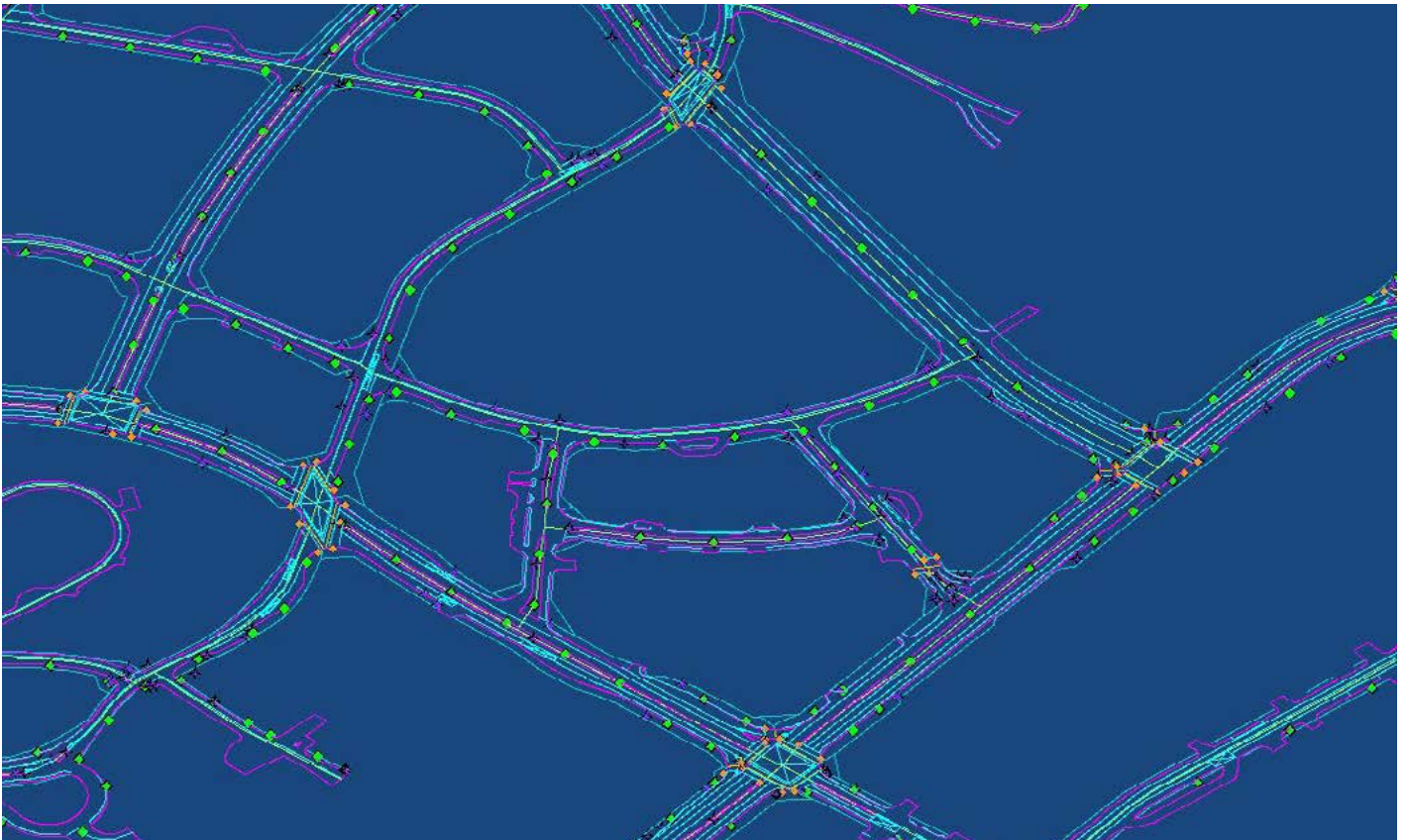nning and mapping. His role in GPS Lands is mainly to craft solutions or workflow utilizing scanning to fulfill client's needs such as feature extraction, 3D modeling, indoor mapping and visualization, and so on.

ABOUT GPS LANDS (SINGAPORE)

GPS Lands (www.gpslands.com) was Founded in 2000 and headquartered in Singapore, GPS Lands focuses on providing the Mapping & Surveying and Geomatics Engineering sectors with modern Hardware & Software technologies.

The past 10 years, GPS Lands has focused much on technologies related to Smart Cities and Digital Twin content creation. With Orbit GT Technologies within the solutions offerings portfolio, GPS Lands is well positioned to enter new markets and adding to the value creation of clients, governments and stakeholders.

Extracted features overview