Geo-referencing of Multi-station Terrestrial LiDAR Data Using Precise GPS positioning data

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Abstract: Terrestrial LiDAR is the state of the art technology of collecting 3D spatial data. Point clouds delivered by a terrestrial LiDAR refer to a local coordinate system defined by the laser scanner. For some applications, raw point clouds should be transformed into a unified ground coordinate system, i.e., geo-referencing of point clouds. Geo-referencing of terrestrial LiDAR data is currently achieved by using control points. Using control points for geo-referencing is often troublesome and laborious, because it involves target setups and additional field survey. Additionally, the accuracy of geo-referencing varies subject to the quality of used control points. A direct geo-referencing system necessarily employed for a mobile LiDAR system is certainly too expensive to the use of a terrestrial LiDAR. However, it is quite common for a modern terrestrial LIDAR to have a mount for GPS antenna. It means that the precise position of a scan station can be obtained in the field. Under this circumstance, geo-referencing of terrestrial LiDAR data can be achieved by combining several (at least three) overlapping point clouds scanned from multiple stations. This is the idea motivates this study.

This paper reports a preliminary study on how much the information of GPS precise positioning can help a terrestrial LiDAR to achieve geo-referencing. The experiment conducted in this study is to show the quality of geo-referencing may be achieved by using a commercial hardware and software system without the use of ground control points. The applied scanner was Riegl VZ-400 integrated with a Tremble R4 GPS receiver. The data were processed using Riegl RiSCAN. The point clouds of multiple stations were collected in a test field for validation. There are 24 object targets distributed on the walls of the surrounding buildings in the test field of which the 3D positions were precisely measured as check points. The geo-referencing was performed using Riegl software by combining all point clouds and registering the combined data with the GPS positioning data. The results will be validated by using those check points. Until now, the experiment has not been done yet. The full paper will cover the overall information of the experiment.

Keyword: Terrestrial LiDAR, Geo-referencing, Laser Scanning, Point cloud, GPS