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Geoscientific Instrumentation Methods and Data Systems Discussions



# *Interactive comment on* "Dense point cloud acquisition with a low-cost Velodyne VLP-16" *by* Jason Bula et al.

**Anonymous Referee #1**

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I like the idea to create a 3D terrestrial laser scanner from low-cost components. The combination of a profile scanner (e.g. Velodyne) with a rotation drive on a tripod is reasonable but not novel in principle. The authors demonstrate that the concept works in general and they describe the system and the processing scheme adequately. However, I have some critical points to address. Here are the main points which argue for "major revision", other and more detailed comments and suggestions can be found in the attached document.

- There are other projects where 2D profile scanner used to form a low-cost 3D scanner and this is not mentioned at all. Some examples are given as comments in the attached commented document.

- There are several publications on geometric modeling and calibration of terrestrial 3D



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Discussion paper

laser scanners. The authors give no credit on that and does ignore these approaches completely. They develop there own geometric model and calibration instead, which is at least questionable (as they conclude by themselves).

- The above mentioned geometric models as well mostly base on the know error sources of geodetic instruments (theodolite, total station) which have the same structure as terrestrial 3D laser scanners and also the presented device. The parameters are different axis and eccentricity errors, where equations are presented in geodetic standard literature. Why is that not considered? There are no equations given at all.

- The evaluation part is not very scientific to assess the performance of the system. It seems the system works, and the authors claim it works well for their applications. However, the readers might like to wish a better proof in terms of a thorough scientific analysis in order to be able to assess the suitability of the instrument for other applications as well. To mention some examples: the analysis bases only on a fitted plane to the point cloud of the floor and does not cover the whole field of view. There are only 4 scans which produced completely different calibration values and there is no hint on the parameter's significance. The reproducibility test compares only 2 scans for different scanning speeds, which does not really allow for conclusions. Why the data are not compared to a reference model or reference scan with a superior precision? Some illustrating figures (color-coded point cloud comparison) would be more than desirable (even though only with the fitted plane and the floor points). The most often used approach would be the use of 3D check points and a thorough comparison of the coordinates (RMSE). There are some more comments within the attached document.

- I can not really understand why the presented system is always compared to IMU- or SLAM-based mobile scanners. From my point of view this is not reasonable, as MLS and TLS have different advantages and subsequently different applications scenarios. It is obvious that the point cloud of a tripod-based device is more precise as the whole point cloud from one position is within the same coordinate system per definition than a handheld mobile device where each single point has to be tracked. Therefore

I would absolutely prefer a comparison with other (maybe "low-cost“ 3D scanners), such as Leica BLK 360 oder FARO FocusM 70 (ca. 20.000 $ second hand below 10.000 $ or for rent 100-200$ per day), this would be more fair in terms of an adequate assessment of the device at hand.

Please also note the supplement to this comment:
https://www.geosci-instrum-method-data-syst-discuss.net/gi-2020-3/gi-2020-3-RC1-supplement.pdf

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