UNIVERSITY TRANSPORTATION CENTER

RESEARCH BRIEF

Assessing the Feasibility of Utilizing UAS-based Point Cloud in Pavement Smoothness/Roughness Measurement

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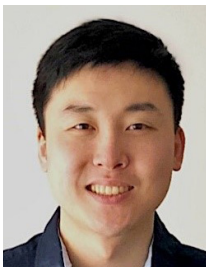
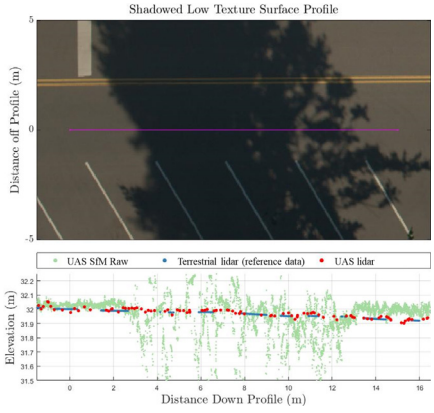


Background

Pavement roughness is a measure of the comfort level experienced by the drivers when driving on a roadway and is a key factor in determining highway satisfaction. The International Roughness Index (IRI) is a commonly used metric to quantify the pavement smoothness/roughness. Transportation agencies commonly measure the IRI of the road surface along highways by utilizing a high-speed inertial profiler mounted to the vehicle. However, it is challenging for transportation agencies to deploy such specialized equipment to survey a relatively smaller area that needs to be monitored more frequently. Additionally, a ground-based system has a limited field of view such that they do not provide the context of the scene.

Unmanned Aircraft System (UAS) has been widely used in a variety of transportation applications given its ability to reconstruct 3D information via photogrammetry, Structure-from-Motion (SfM) and MultiView Stereo (MVS) techniques. The rich geometric information can be acquired via the high-resolution UAS 3D point cloud on a lot of features on and off the highway to provide more useful context. Additionally, the UAS also enable the ability to acquire rich data efficiently and at a low cost for smaller areas. Therefore, they can potentially complement the existing ground systems such as high-speed inertial profiler and mobile lidar data given their limitation of field of view and scan geometry.



Research Project

UAS approaches do have limitations as predicting the accuracy and quality of the UAS-based point cloud data can be very challenging and complicated as the resulting data can be affected by many factors (e.g., sensor calibration, flight plan, system specifications, texture of the surface, lighting conditions, ground control, processing algorithms/software, etc.). UAS-based point clouds typically have a higher uncertainty than lidar-based point clouds, especially for the areas with a low surface texture or poor lighting. Thus, it is important to report the absolute or relative uncertainty with the roughness measurements such that they can be combined with or compared. Considering the limitations, there needs to be a rigorous accuracy assessment to validate the feasibility of utilizing UAS data to evaluate pavement roughness. In addition, because there are few guidelines or standards in UAS data collection and processing workflows in general, it is critical to have application- or case-oriented guidelines available to ensure the data satisfies the accuracy requirements of the project. This project will develop a framework to obtain pavement roughness metrics (e.g., IRI) from UAS acquired lidar and structure from motion point clouds, validate the viability of assessing pavement roughness using UAS-based point cloud data, and provide general guidelines for UAS data collection and processing targeting extraction of pavement information.

ABOUT THE AUTHORS

The research team consisted of Ezrhuo of Oregon State University.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

March 2022

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/assessing-the-feasibility-of-utilizing-uas-based-point-cloud-in-pavement-smoothness-roughness-measurement/