Summer 2018

3-D Photogrammetry for LiDAR Calibration

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Introduction

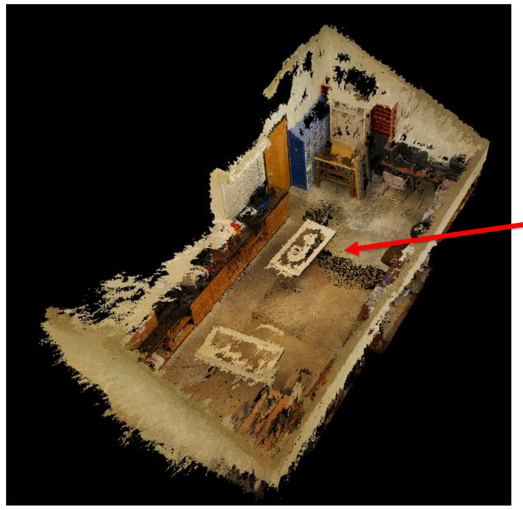
The growth of drone technology has provided an avenue to create 3-D images of a desired region. We combined photographs to create a point cloud model which we compared to a point cloud created from the LiDAR (Light Detection And Radar) data. By comparing these two point clouds, we can later determine calibration variables for the LiDAR system.

Above, Montana Tech construction lot point cloud.

Photogrammetry

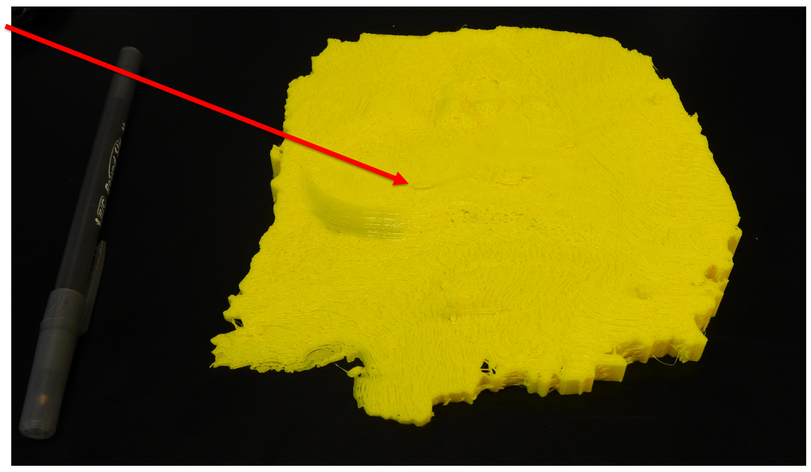
- Photogrammetry is the process of using photographs to create a 3-D model of an area.
- We used photogrammetry to model a construction lot and an indoor lab on Montana Tech's campus.
- We processed the images using Pix4D mapper.
- Pix4D stitches the images together using similar pixels to create a point cloud.

Below, point cloud model of the indoor lab generated using Pix4D.



3-D printing

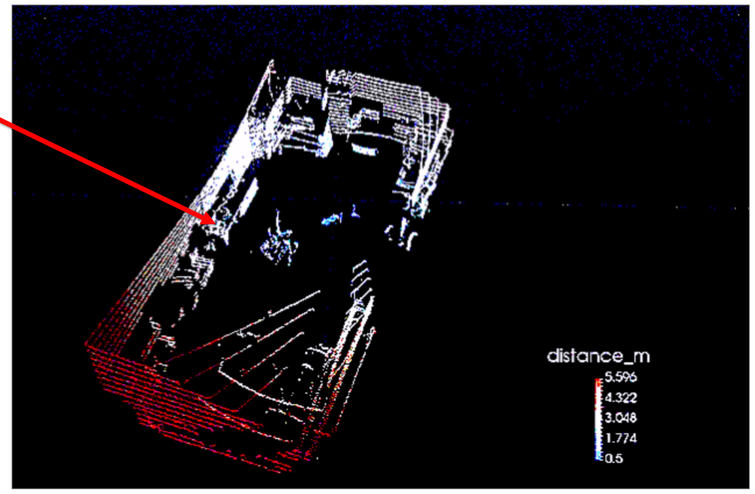
- The printer that we used was the Anycubic i3 Mega.
- This 3-D printer uses a heated bed and heated nozzle to melt plastic filament which then prints a computer generated model.
- We printed an elevation model of the construction lot.



Above, 3-D printed model of the construction lot. The view is of the lot from south to north. The pen is shown for scale.

LiDAR

LiDAR is a survey method of measuring distance to a target using a rotating laser light to create 3-D models.



Above, a screenshot from data taken in the lab using a Velodyne VLP-16 LiDAR. By running the LiDAR data through a SLAM (simultaneous localization and mapping) algorithm, we can create a point cloud to compare with the photogrammetry point cloud.

Conclusions

- During this project we used a drone and photogrammetry to produce a 3-D elevation model of a construction site west of Montana Tech.
- We printed this model on a 3-D printer.
- We then modeled an indoor lab on the Montana Tech campus using both photogrammetry and LiDAR.
- These techniques will help us anticipate roadblocks that we may encounter while testing a drone mounted LiDAR during large scale tests to calibrate the LiDAR system.

Acknowledgments

This work was supported by Montana Tech's Summer Undergraduate Research Fellowship (SURF). We thank Jesse Bunker for helping with electrical wiring and drone work.