CNST-2550: 3D LASER SCANNING FOR LAND SURVEYING

Cuyahoga Community College

Viewing: CNST-2550 : 3D Laser Scanning for Land Surveying

Board of Trustees:
December 2024

Academic Term:
Fall 2024

Subject Code
CNST - Construction Engineering Tech

Course Number:
2550

Title:
3D Laser Scanning for Land Surveying

Catalog Description:
Introduction to the methods and procedures of 3D Laser Scanning for land surveying applications. Aerial and terrestrial methods of data acquisition will be explored. Quality assurance and quality control. Processing collected data will be done using AutoDesk and/or ESRI software packages.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
2

Requisites

Prerequisite and Corequisite
CNST-2110 Basic Survey Practices; and CNST-2500 Construction Surveying or CNST-1740 Fundamentals of Geographic Systems; or department approval.

Outcomes

Course Outcome(s):
Collect and process LiDAR Data.

Essential Learning Outcome Mapping:
Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):
1. Process LIDAR data collected and create a point cloud.
2. Explain methods for data acquisition using laser scanning.
3. Explain how environmental conditions can impact the quality of data collected.

Course Outcome(s):
Apply data collected to generate deliverables.

Essential Learning Outcome Mapping:
Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Create a surface model from data collected.
2. Create contours lines from data collected and explain levels of accuracy.
3. Perform acreage calculations from collected data.
4. Perform an inspection of a structure using laser scanning methods.

Methods of Evaluation:

1. Exams
2. Quizzes
3. Homework
4. Laboratory Activities

Course Content Outline:

1. Introduction to LIDAR
   a. Introduction to remote sensing
   b. Multispectral remote sensing
   c. Hyperspectral remote sensing
   d. Radar and LIDAR remote sensing
2. LIDAR Data Acquisition
   a. Basic components of LIDAR
   b. Physical Principles of LIDAR
   c. Accuracy
   d. Data formats and systems
   e. Data classification and processing
3. Data classification and processing
   a. Filtering methods
   b. Classification of non-ground points
   c. Spatial interpolation
4. Supplementing LIDAR Data
   a. Filtering methods
   b. Classification of non-ground points
   c. Spatial interpolation
5. Typical Deliverable Products and Formats
   a. DEM (Digital Elevation Model); TIN (Triangular Irregular Network); and other 3-D formats
   b. Working with models in Autodesk and ESRI Environments
   c. Overview of LIDAR applications and deliverables
6. Quality Control
   a. Comparison to other data sources
   b. Impact on accuracy
   c. Merging multiple models/formats
7. LIDAR Applications
   a. Forest Applications
   b. Urban Application
   c. Hydrology and landforms applications

Resources

McManamon, Paul. (2019) *LiDAR Technologies and Systems*, SPIE--The International Society for Optical Engineering .

Dong, Pinliang. (2018) *LiDAR Remote Sensing and Applications*, CRC Press.

Ghilani, Charles D. . (2021) *Elementary Surveying: An Introduction to Geomatics*, Pearson.

Resources Other

1. URISA LIDAR Guidebook (2005) https://www.urisa.org/clientuploads/directory/Documents/Books%20and%20Quick%20Study/lidar_guidebook.pdf
2. Virginia DOT Surveying Manual (2021) https://www.virginiadot.org/business/locdes/survey_manual.asp
3. ODOT Surveying and Mapping Specifications (2023) https://www.transportation.ohio.gov/working/engineering/cadd-mapping/survey-mapping-specs
4. GeoSLAM Introduction to LIDAR website (2023) https://geoslam.com/resources/

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