

MODULE 4.

PERFORMANCE OF 3D LASER SCANNING HARDWARE AND SOFTWARE

Learning Outcomes:

This module discusses the performance of 3D laser scanning hardware and software from various vendors using the data gathered by POB. Students will learn the capabilities and performances of the scanners and software from various vendors and will be able to make informed decisions in scanning system acquisition.

Lecture Contents:

This lecture is based on the survey conducted by POB. The details for hardware can be found at this link: <http://laser.jadaproductions.net/hardware/detail2.php?v=all> and software at: <http://laser.jadaproductions.net/software/detail2.php?v=all>

For the hardware the survey included these areas:

- Laser wavelength
- Laser power
- FDA laser classification
- Beam diameter at specified distance
- Measurement technique
- Average data acquisition rate
- Distance accuracy at specified distance
- Position accuracy at specified distance
- Angular accuracy
- Minimum range
- Maximum range at specified reflectivity
- Field view – vertical
- Field view – horizontal
- Minimum vertical scan increment
- Minimum horizontal scan increment
- Surface reflectivity range
- Onboard camera for aiming or for creating photomosaic
- Interoperability with optical total station and GPS
- Is the scanner better for scanning topography or for as-built survey?
- Can scanner be set up over a known point?
- Can the user specify the field view and scan density?
- Maximum sample density
- Does the scanner support scan filter?
- Is software technology for processing data available from scanner manufacturer?
- Interchangeable parts that allows for upgrades
- Communication method
- Does the scanner operate when out of level and does it have compensators?

- Resolution and range of compensators
- Storage temperature range
- Operating temperature range
- Humidity
- Ambient light
- Scanner dimension and weight
- Type of Tripod to be used
- AC power requirement
- DC power requirement
- Batteries (voltage, dimension, weight, life)
- Battery hot swappable
- Computer requirement for control
- Computer requirement for data processing
- Optional accessories

For software, the survey looked at these areas:

- Hardware requirements
- Types of files that can be processed (from different vendors)
- Use of feature codes
- Compare cloud or shapes fitted to cloud to plan or perform theoretical shape and inference check.
- Ability to make measurement, such as distances, angles, areas, volumes based on clouds.
- Overlay or drape photographs
- Ability to register scans without use of targets
- Georeferencing
- Analyze points in a cloud representing shapes such as planes, cylinders and sphere to detect measurement outliers
- Ability to integrate scans with floor plans, engineering drawings of objects and surveying information
- Automatic decimation of points in selectable areas to make data files as compact as possible
- Is fitting of lines, planes and shapes done manually, automatically or both?
- For automatic fitting, what techniques are available?
- Ability to automatically track lines or limits of areas by color or texture discrimination
- Ability to automatically calculate and list alignment of centerline of shapes containing straight and curved segments such as elbows
- Maximum number of points that can be loaded
- Model creation from point clouds
- Are items (CAD models) fit to the point cloud using standard object lists?
- Create statistical quality assurance reports on the modeled objects
- Mesh generation with and without user intervention
- Contour generation

- Volume calculation
- Solid modeling
- Profile, cross-section
- Edge detection technology
- Perform automatic extraction of standard shape from clouds
- Can user view cloud or generated shapes or models from any viewpoint in 3D
- Is fly-through or walk-through supported?
- Display of details depending on scale of the view
- Can user select transparent/opaque surface for cloud and CAD shapes?
- Export formats supported
- Other measurement tools
- Can the point cloud be rendered with visualization effects?
- Can the software automatically detect scan targets?
- Provide high-speed thumbnail views of scans, clouds, photographic images and generated shapes?
- Client/Server system that support multiple users
- Is client/server system supported to enable several clients contributing to a single project?

Questions:

1. What is the range of laser wavelengths used for the scanners current on the market?
2. What percent of the scanner is TOF based? And what percent is phase-shift based. What can you say about the measurement ranges of these two types of scanners?
3. From your point of view as a land surveyor, what are the most important features that hardware must have?
4. From your point of view as a land surveyor, what are the most important features that software must have?
5. Based on information presented in the POB survey, which scanner is the best and which software is the best? For your job, will any of these scanners and software meet your requirements?
6. In many projects, cost/benefit analysis is an important part of the decision making process. Perform a cost benefit analysis of the scanner system that you plan to acquire.