POINT CLOUD MANAGEMENT: AN OVERVIEW OF CURRENT PRACTICES AND TECHNOLOGY

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OVERVIEW

What is a point cloud?

Types of scanners

Hardware implications

Working with a point cloud

Outputs from a point cloud

Takeaways
**WHAT IS A ‘POINT CLOUD’?**

Point clouds are the millions of points created by a scanner, all clustered together to form an environment or definition of a three-dimensional space.

Point clouds are formed through many different methods.
PHOTOGRAMMETRY

• Software used to assemble images
• Used for generating 3D models and/or point clouds
• More sophisticated versions can yield results that are as accurate as LIDAR
• Requires illumination
• Significant cost savings over LIDAR in most cases
STRUCTURED LIGHT SCANNERS

• Project patterns of light
• Using cameras and software, interpret the alteration of the pattern
• Generate models and/or point clouds
• 2 scanner primary types
  • Static
  • Handheld
SONAR SCANNERS

• Generate point clouds from software interpretation of sounds waves
• Different configurations can generate greater accuracy, cover larger areas, or get live 3D images
• Sound wave interpretation allows the gathering of point cloud data that would otherwise be unreachable by other scanner types
LIDAR SCANNERS

• Emission of laser pulses and recording what happens to those pulses

• Two types
  • Time of flight (pulse based)
  • Phase based (continuous beam)

• Mobile scanning
  • Airborne; typically time of flight waveform processing
  • Ground based
POINT CLOUD TYPES
Structured vs. Unstructured and why it matters

• Unstructured Point Clouds
  • A collection of points gathered using previously mentioned methods
  • No intelligence between the points, it's the same as having a photograph, what you see is what you have.
  • Unable to leverage point cloud processing software

• Structured Point Clouds
  • Include relational information from point to point along with the positional information that is always collected
  • Can contain multiple properties including XYZ, RGB, intensity, and normal values along with relational information
  • Point cloud processing software can be leveraged

• Why does it matter?
  • Depending on intended use of point cloud, software can denoise the project, generate CAD from the environment, import external geometry, run tests and projections, etc.
  • This enables a user to perform a variety of project-enhancing operations
HARDWARE RECOMMENDATIONS

• More RAM is a plus

• A dedicated graphics card helps guarantee a smooth experience

• Disk type and space matters
  • SSDs are better than HDDs (faster read/write speeds)
  • Point cloud projects can get very large very quickly, so the more space the better

• A scanner of some kind is necessary to gather point cloud data, whether it’s through photogrammetry, LIDAR, Sonar or others, a scanner will be necessary to capture the environment
FIVE PROCESSES FOR UTILIZING A POINT CLOUD

1. Registration
2. De-Noising
3. Modeling
4. Analysis/Simulation
5. Output
REGISTERING A POINT CLOUD

• This is the first step in the process of utilizing a point cloud
• The points captured are oriented correctly, different scans are overlaid or lined up, and a coordinate system is established if not already present
DE-NOISING A POINT CLOUD

- When scanning an environment, sometimes the same area is captured multiple times, generating noise. De-Noising a point cloud makes the environment smoother and lighter.
- Kinetic noise is often a problem as well. When someone or something passes through a scan, it can generate random clouds of points that cause unnecessary noise.
MODELING WITHIN A POINT CLOUD

- Point Isolation
- Mesh Creation
- Utilization of the Mesh
- Export to CAD or BIM Software
ANALYSIS/SIMULATION UTILIZING A POINT CLOUD

• As built vs as designed validation
• Collision detection
• Interference checking
• Layout planning
OUTPUTS FROM A POINT CLOUD

- 3D models and mesh models
- 2D drawings
- BIM environments
- Fly through videos
- Server based web viewing and collaboration
TAKEAWAYS

• Point clouds provide digital environments that allow for multiple use cases that enable more efficient workflows
  • As built vs as designed comparison
  • Layout planning
  • Digital measurements
  • And more

• Point clouds should not feel intimidating
  • Typically a 5 step process from import of the captured data to export of the desired output
  • Hardware makes a big difference
CONCLUSION

• There are multiple methods of capturing point clouds
  • LIDAR
  • Sonar
  • Photogrammetry
  • Etc.

• There are two primary forms of point clouds
  • Structured
  • Unstructured

• Point clouds fulfill many industry use cases making workflows easier and time to delivery shorter
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Thank You!
QUESTIONS?