Optimizing Point Cloud Data for the 3D Digitalization of the Physical World

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Agenda

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• Presenter background
• Company overview
• Point cloud use cases and issues today
• InfiPoints solution overview
• Demos
• Customer case studies
• Q&A
Danielle (Williams) Perelli
Customer Engagement Specialist - Elysium Inc.
• Manage customer engagements to address Data Migration, Multi-CAD Interoperability/Collaboration, Data Quality Management, Data Optimization, and Validation
• Collaborate with technical team members, development, and Elysium offices globally on product enhancement, global marketing, and to support customer engagements

Nate Soulje
Application Support Specialist - Elysium Inc.
• Collaborates with sales and development to support both current and future customers with Elysium solutions
• Focused on industry knowledge in topics such as MBD/MBE, LOTAR, Validation, etc.
• B.S. in Nuclear Engineering
• M.S. in Mechanical Engineering
• Over 30 years of CAD expertise
• Strong partnerships with CAD vendors
• 3D Data Expertise:
  • Translation
  • Geometry Healing
  • Quality Management
  • Validation
  • Simplification
  • Reverse Engineering / Point Cloud Rendering
• Off-the-Shelf, OEM, & Migration Services
Elysium Solutions

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• 3D Data Translation
  • Geometry, product structure, PMI/FTA, attributes, features, constrains, etc.

• 3D Data Applications
  • Optimization, validation, quality checking and healing, polygon operation, point cloud handling, reverse engineering
Use Cases of Point Cloud Data
Easily measure dimensions of your equipment and facilities without the haste of facing danger of hand measuring.
Digitally capture as-built products, systems, facilities, etc.
Clip out an equipment to examine before/after of construction
Automatically extract planes/cylinders from point cloud to easily perform CAD modeling
• Specific points need to be determined to perform **measurements** which can be inaccurate and take time
• Manually cleaning up **noise** within the data is extremely time consuming
• Point cloud data can be very **large and difficult** to work with
• A lot of **manual work** can be required when modeling features like pipes and equipment
• It can take **multiple software packages** to prepare the data for downstream uses
• **Limited formats** to work with, such as CAD formats
• **Collaboration** can be difficult
What is InfiPoints?

- A large scale point cloud handling tool developed by Elysium
- Used in various industries/fields
Comprehensive Software to Facilitate the Entire Process of Point Cloud Utilization

Point Cloud Utilization Flow

InfiPoints, your One Stop Solution streamlines the process
Easier Utilization of Point Cloud Data

Reducing Time for Data Preparation

- Dramatically reduce time and labor to prepare data for utilization by easily registering multiple scans from a laser scanner and performing powerful noise reduction

Smoothly Work in a Large Scale Environment

- Billions of points will not stop you from smoothly handling your point clouds
- Dramatically reduce time and labor of modeling by using plane/cylinder automatic extraction and tools
Data Preparation Time Reduction Scenario

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1. Conventional Workflow

Local Measurement by Hand → Drawing Creating by Hand

2. After 3D Laser Scanner Implementation Workflow

Scanning → Point Cloud Processing → Digital Measurements → Modeling in a BIM Software by Hand → 2D Drawing Creation in a BIM Software

Effect of 3D Laser Scanner

3. After InfiPoints Implementation Workflow

Scanning → Pre-processing → InfiPoints Digital Measurements → Feature Extraction → 2D Drawing Creation in a BIM Software

Effect of InfiPoints

50% Reduction in time!
InfiPoints supports your one-stop point cloud utilization in the following 5 processes:

1. Data Import
2. Data Pre-processing
3. Analysis
4. Modeling
5. Collaborative Outputs
Data Import

• Import multiple scan data formats including native scanner data
• Viewing of large scale point clouds (billions)
Register Point Clouds from Different Scanners

Register your point cloud data from data coming from both a tripod scanner and a mobile scanner.
Data Pre-processing

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- Markerless Automatic Registration
- Automatic Noise Reduction
- Target Recognition, Coordinate Transformation

In collaboration with

BC Engineering and Design
Markerless Registration

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Registration Evaluation Report

Index
1. Overview | Evaluation Result in Images
2. Evaluation Result | Pan Scan Shot
3. External Reference Points
4. Targets (Internal Reference Points) Used for Evaluation
5. One between Scan Shots
6. Gap between Target and Corresponding External Reference Point
7. Gap between Targets (Internal Reference Points)
8. Evaluation Result by Extracted Planes | Between Paired Shots

Overview | Evaluation Result in Images

Top - Target_Edge
Automatic Noise Reduction

Overlapping Noise
Automatic Noise Reduction

Removing Kinetic Noise
• Measurements using extracted planes/cylinders
• Real-time interference check along path and with interaction
• Comparison between CAD and Point Cloud
Measurements Using Extracted Planes/Pipes
Case Study - Ceiling Crane Rail Measurements

Reduce dangerous height work using digital measurements
Path creation, movement of CAD model along the path and performance of real-time interference checking
Save your CAD model path movement as a movie as well
Comparison Between CAD and Point Cloud

Overlay a CAD model to a scanned point cloud data and extract deviation

Examine deviation between planned and result or
used for monitoring of secular changes of equipment
Case Study: Examine Inclination of Construction Plane

Prevent implementation problems of equipment by checking inclination of the construction plane.
Modeling

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- Mesh Creation
- Pipes
- Equipment
- Steel Structures
- Ducts
Layer Classification of Point Cloud for Mesh Creation

Mesh Creation
Pipe Modeling
Pipe Modeling
Case Study-Existing Pipe Renewal/Construction

Check connection of pipes to an existing equipment and estimate new piping needed for construction
Case Study-Piping Renewal Study

Cut a cross section of your desired area and measure walls and near ceiling areas

Very difficult to hand measure and not have any human errors

Example of a section view displaying pipes near the ceiling
Equipment Modeling

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Case Study - Equipment Modeling CAD Connection

Use automatically extracted planes/cylinders of InfiPoints to complete your workflow in other software.
Modeling of H-beams, I-beams, etc.
Steel Structure Modeling
Duct Modeling

Added duct exclusive modeling function utilizing automatically extracted planes
Collaborative Outputs

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- Export Ortho Images
- Fly-through Movie
- Export Viewer File
- External Links
Specify a reduced scale and export high precision ortho images. Import into a 2D CAD for drawing creation reference or print it out for information sharing.
Fly Through Movie

Creating fly-through videos easily by specifying several viewpoints
Export a viewer file for distribution to other departments or clients. Point cloud data could be viewed without an installation or the license of the application.

<Possible things in the viewer file>

1. Viewing of point cloud, CAD data, notes and dimension
2. Switching view/hide of layers
3. Section movement along a pre-set path
4. Drawing creation, DWG export [*]
5. Ortho image export [*]
6. Adding dimensions [*]
7. Adding notes

[*] Authority settings could be done at the time of viewer file export

※Point cloud rendering capabilities are the same as that of InfiPoints
※Users could save drawings, notes, and dimensions added in the viewer file
Add notes and comments on the point cloud

Link saved files (i.e. manuals) or attach a reference hyperlink on the point cloud
Viewer File Demo
Supporting Formats

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Main Package

- FLS/FWS
- PTX
- PTS
- DP
- OBJ
- VRML
- IGES
- DWG

- ZFS/ZFPRJ
- CL3
- TXT
- LAS
- STL
- STEP
- ENF
- PTX
- TXT
- PTS
- LAS
- VRML
- OBJ
- IGES
- STEP
- ENF
- CATIAV5
- Parasolid
- ACIS(SAT)
- JT
- CATIAV4
- NX
- Creo Parametric

MREAL

Rhino Plug-in

Options

*1 ENF: Elysium Neutral Format

Options

Options
Head Mount Display

Realize the experience using the head mount display (Oculus) to view your scanned point cloud data.
Point Cloud Web Viewer

Access the server from the client (PC, tablet, smartphone, etc.) and lightly view your point cloud data

- Access a URL in a web browser to view your point cloud
- Software installation is unnecessary on the client side
Customer Case Studies

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• Shinryo Corporation
  • BIM case
  • 30% reduction in lead-time by utilizing automatic registration, denoising, feature extraction, and the CAD JT export

• Tonets Corporation
  • BIM case
  • Utilizing automatic feature extraction, Rebro connection, and IFC export option to other BIM software
    – 2 month process down to 14 days

• Matsue College
  • Silver mine investigation
  • Utilized automatic noise reduction and ground extraction
Customer Case Studies

Shinko Plantech

- Avoid rework by virtually checking for interferences for construction maintenance
- Utilizing automatic feature extraction, polygons, and collision detection, were able to avoid 30 areas that would have caused interference

JFE Plant Engineering

- Looking at the inclination of their plants after earthquakes for maintenance
- Utilizing automatic noise reduction, measurement capabilities, and CAD to Point Cloud validation
  - Saved time, reduced human danger, increased measurement capabilities
Thank You!

Questions?

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