iPad Laser Scanning – Field to Office Workflows

Andy Putch – CEO at SiteScape

Sam Tijan – Senior Virtual Construction Specialist at Miron Construction Co., Inc.

SiteScape

Miron
Building Excellence

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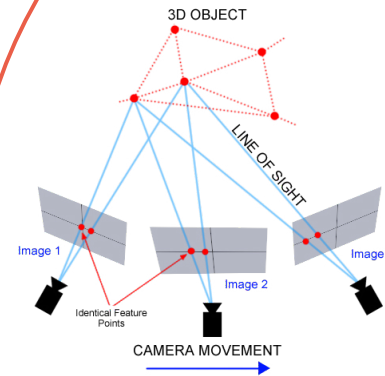
Andy's Backstory

Product Manager at **Drone**Deploy
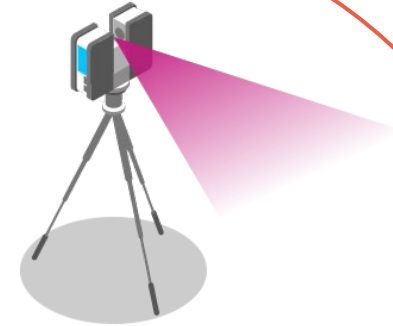
A drone base photogrammetry platform for the enterprise

Existing Reality Capture Solutions

Manual Measurements

Photogrammetry

3D OBJECT

LINE OF SIGHT

Image 1
Image 2
Image 3

Identical Feature Points

CAMERA MOVEMENT

Tripod-based Scanners

Mobile Scanners

Is There Really LiDAR On the iPhone?

SPECS

Solid State, Direct-Time-of-Flight LiDAR sensor

Simultaneous Localization and Mapping (SLAM) System

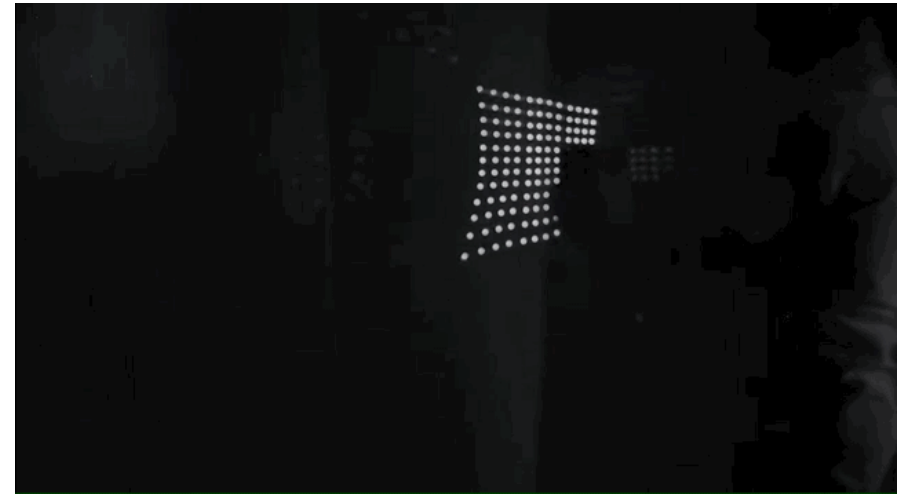Depth sensor range: 15 feet (5 meters)

Depth sensor resolution: 256 x 192 pixels (0.05 MP)

LIMITATIONS

SLAM system location estimate is susceptible to drift accumulation over time

Point-to-point measurements generally accurate to +/- 1" for scans of areas up to 1,000 sqft

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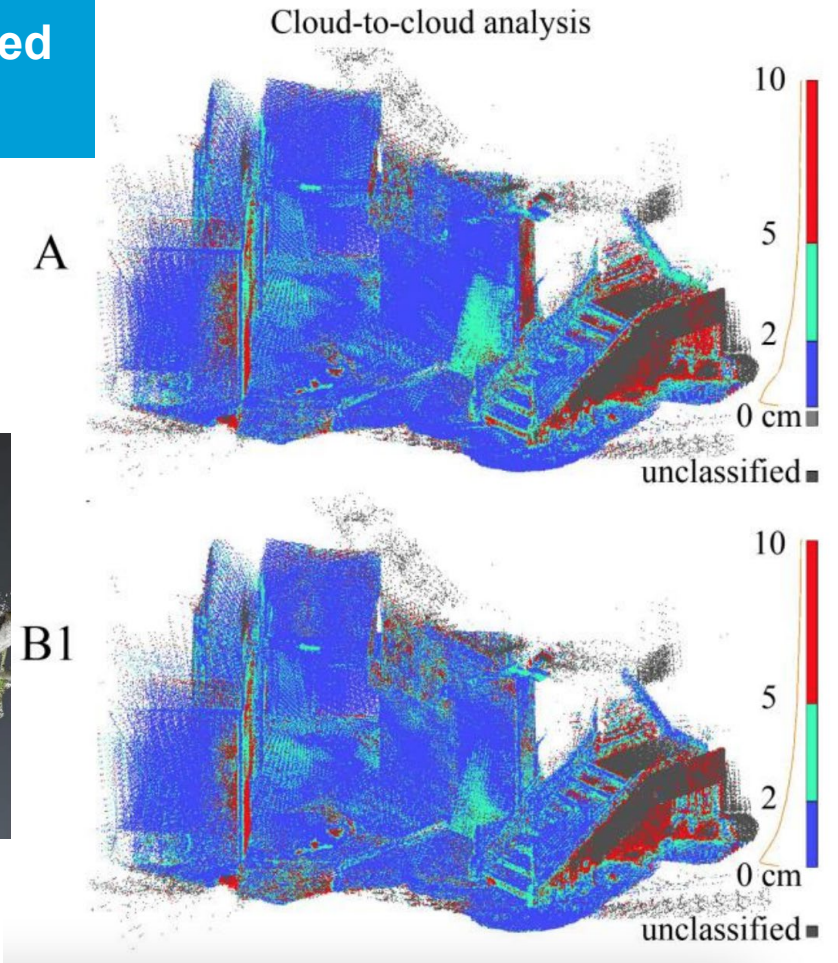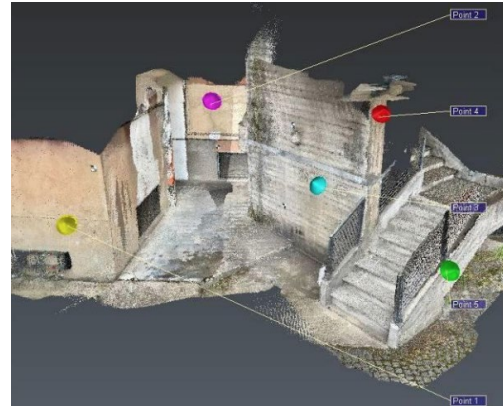FOR CONSTRUCTION PROFESSIONALS

But What About Accuracy?

Point cloud	5 GCPs		4 CPs	
	RMS mean (cm)	St. dev. (cm)	RMS mean (cm)	St. dev. (cm)
(A) iPad - Single scan	1.8	0.7	1.8	0.8
(B1) iPad - raw scans	1.9	0.6	1.5	0.7
(B2) iPad - edited scans	1.9	0.6	1.4	0.6
(C) Faro	0.2	0.1	0.3	0.1

Table 5. Evaluation of the point clouds positioning accuracy: RMS values on GCP/CP.

Point cloud	Cloud to cloud distance		
	0-2 cm	2-5 cm	5-10 cm
(A) iPad - single scan	61%	29%	10%
(B1) iPad - raw scans	70%	24%	6%
(B2) iPad - edited scans	76%	21%	3%

Table 8. Evaluation of the positioning through ICP algorithm to the TLS scans by means of cloud-to-cloud distance without considering portion where gross errors appeared in the previous analysis.
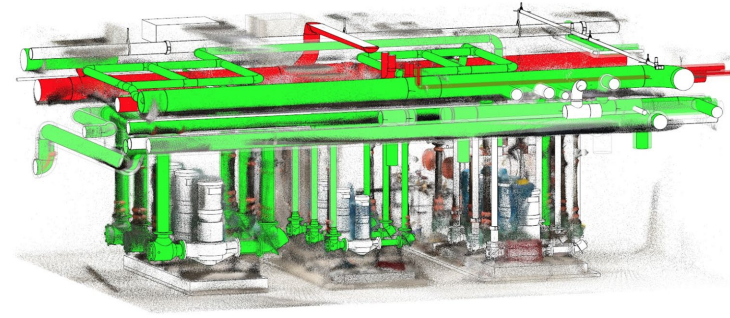

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SiteScape for AEC

A **mobile** & **cloud platform** for capturing 3D scans of jobsite conditions

2. Model existing conditions

1. Document, share, & troubleshoot problems on site

3. Verify as-builts & produce record drawings

North pipe extensions not in point cloud

Round duct is 700mm higher in point cloud

Duct shape discrepancy

Openings without pipes in model

Duct shape discrepancy

661   448

37   545

Pipe not in point cloud

Openings not aligned with ducts in model

Ducts misaligned between model and point cloud

155

757

542

LEVEL 2 - ROOM 2-014 PLAN LOW
1 PC-1   SCALE: 1 : 50

LEVEL 2 - ROOM 2-014 PLAN HIGH
2 PC-1   SCALE: 1 : 50

5 PC-1

3 PC-1

5 PC-1

3 PC-1

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Democratizing the Technology

Field Data Collection

- Software Operation / Training

- Data collection integrity

- Data deliverable to Coordination Team

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Software Operation & Training

What Tools?

Application Interface & Data Collection
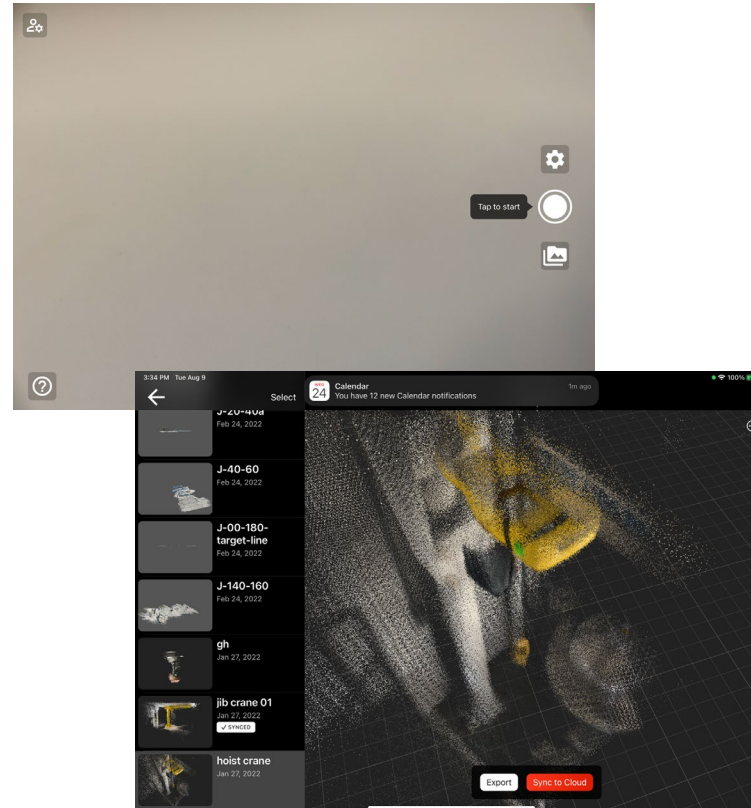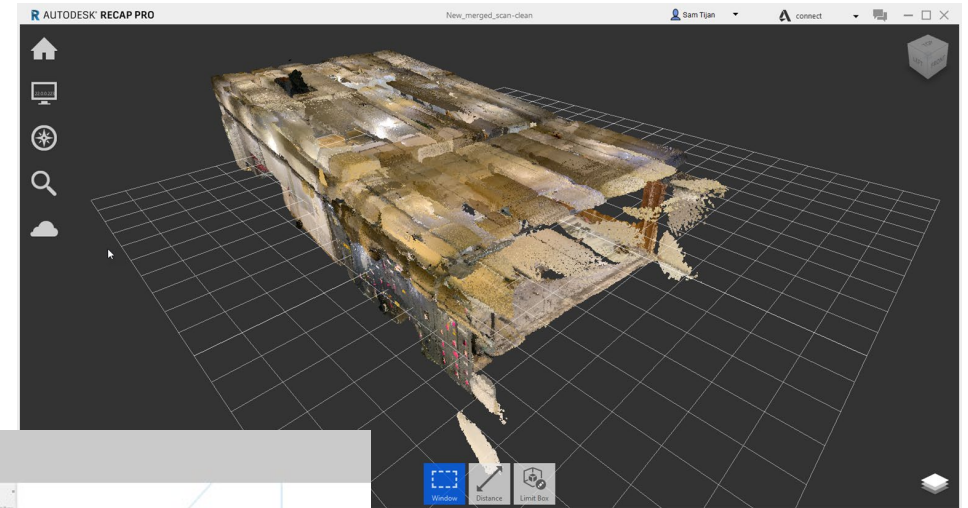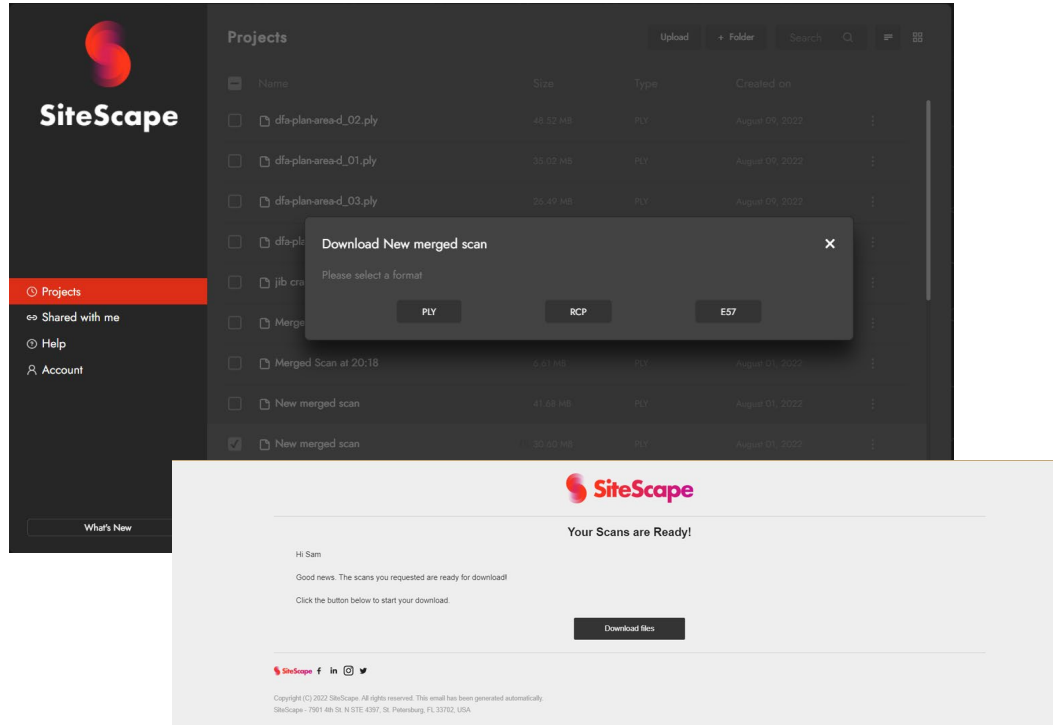
Check Data & Make Available to VC Team

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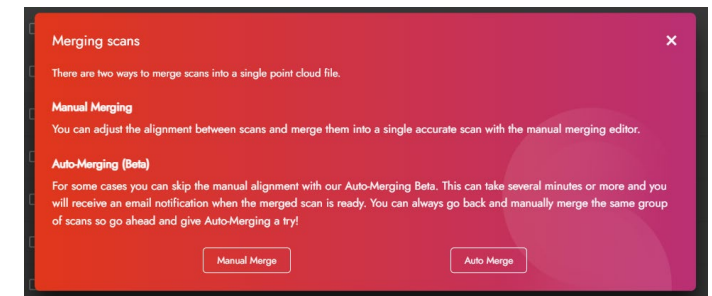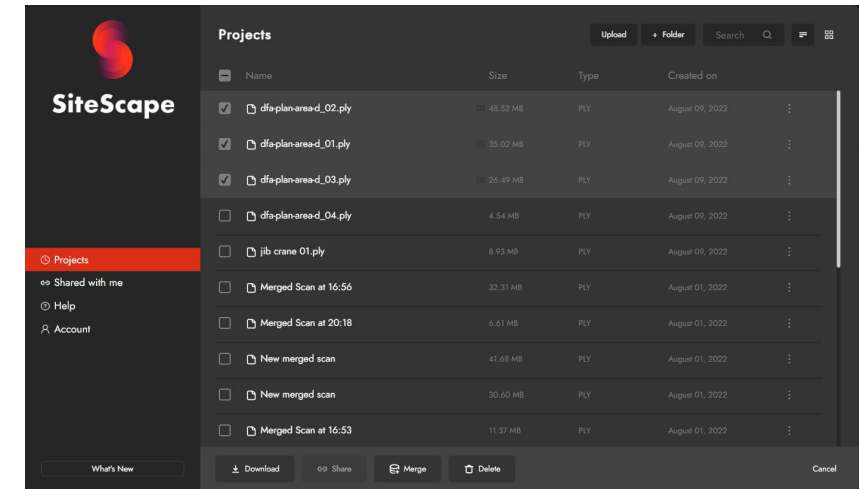
Model Workflow
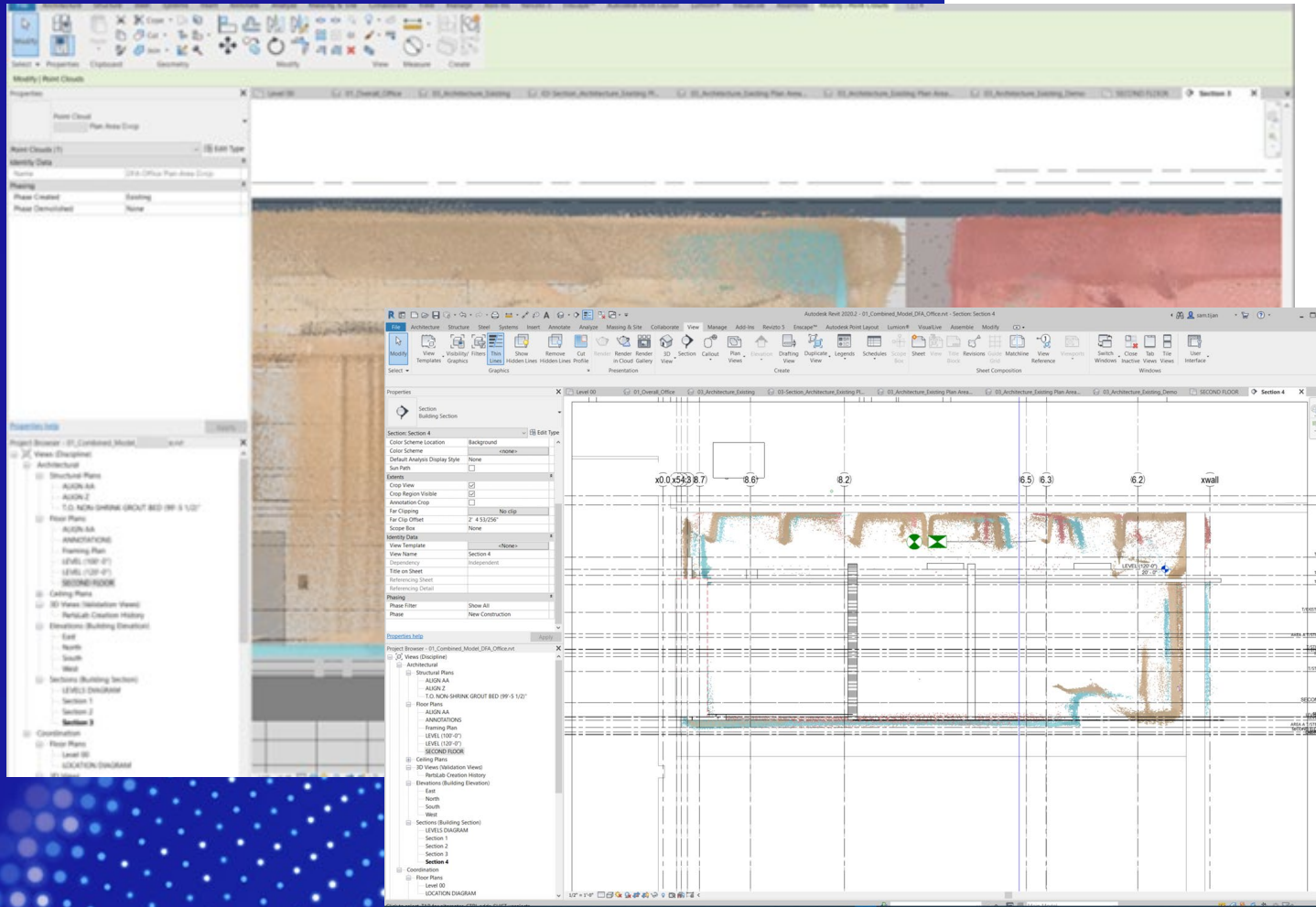
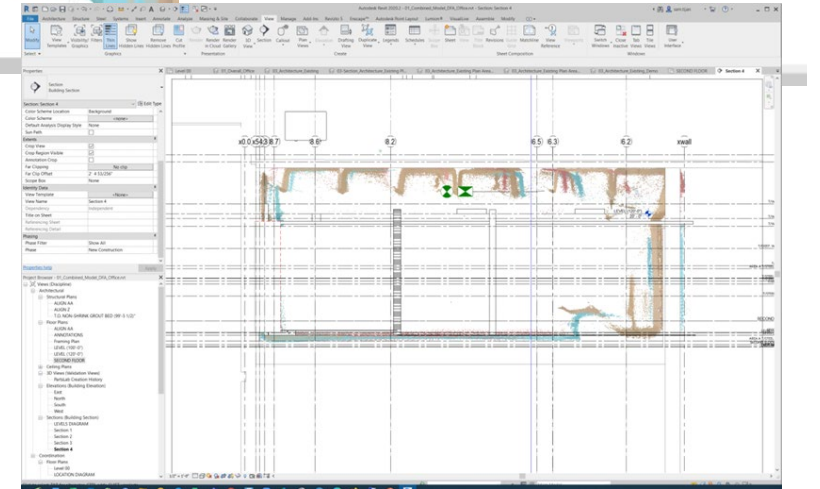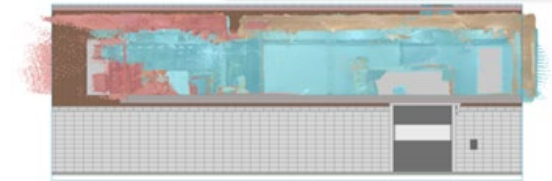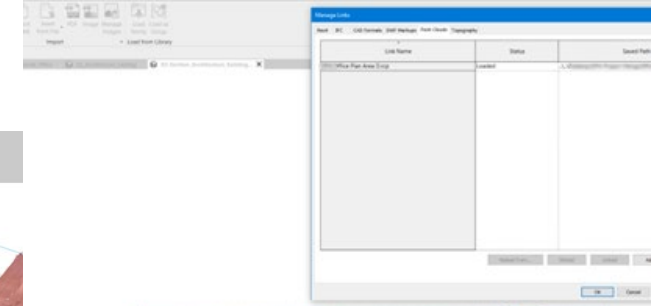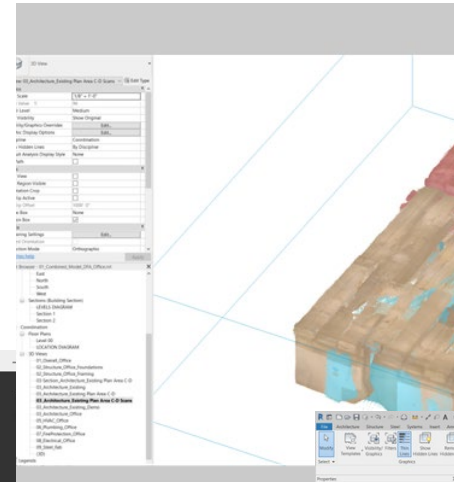- Point Cloud Data conversion
- BIM Coordination
- Use in Design or Fabrication Model
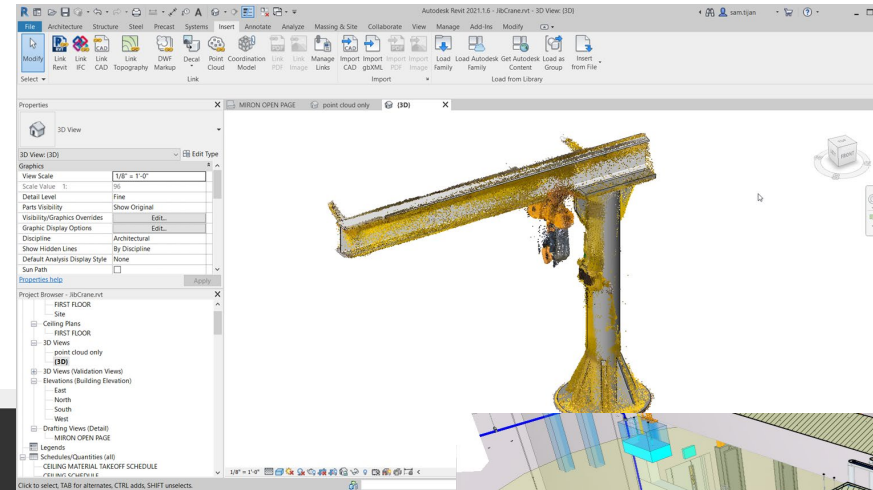
Point Cloud Conversion

Merging and Downloading Point Clouds
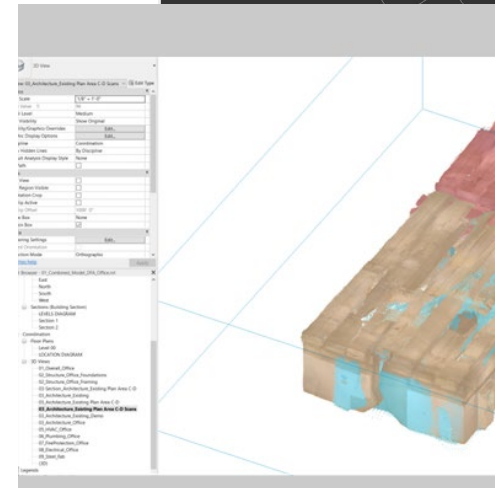
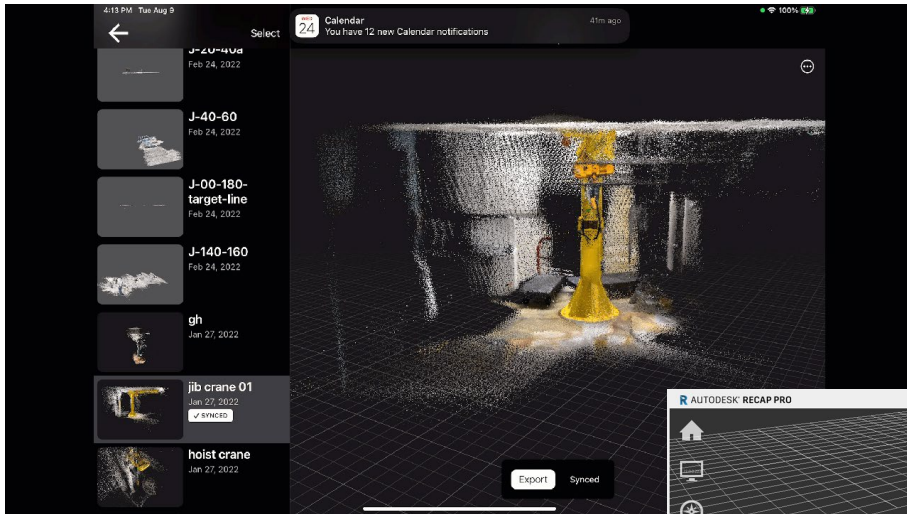# Incorporating Point Cloud into BIM Coordination
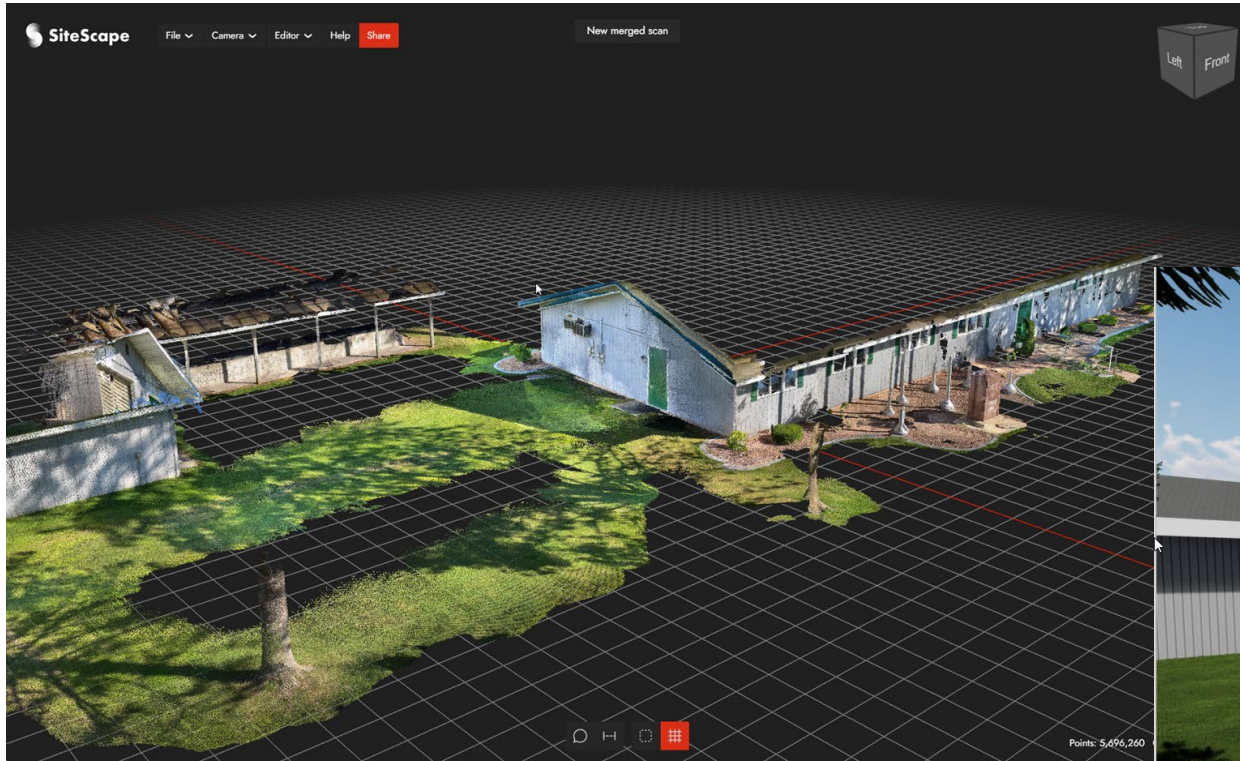
Scan To BIM - Visual Coordination
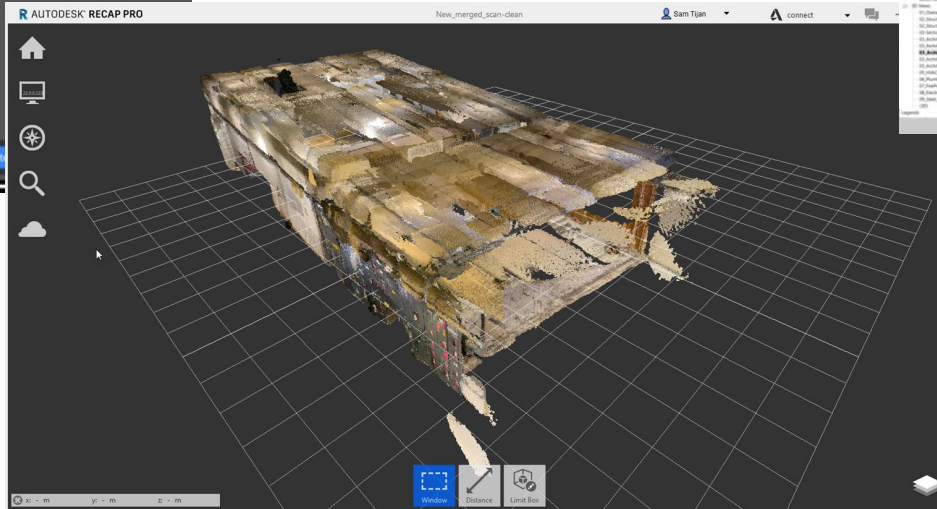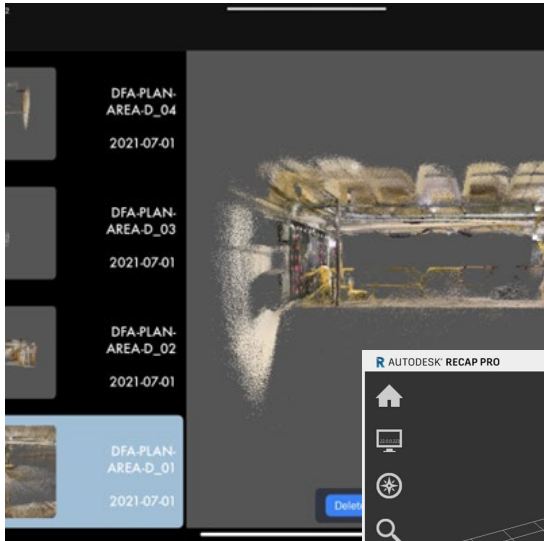
Incorporating Point Cloud into BIM Coordination

Scan To BIM - Clash Detection

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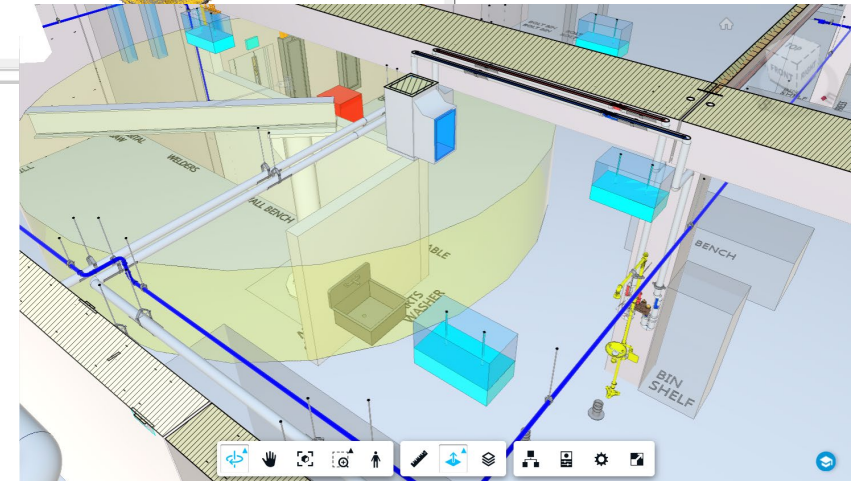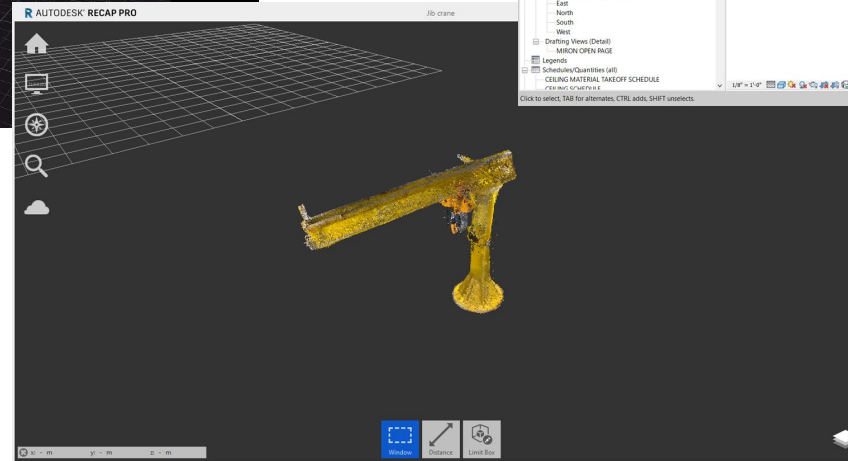
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Using the Point Cloud for modeling
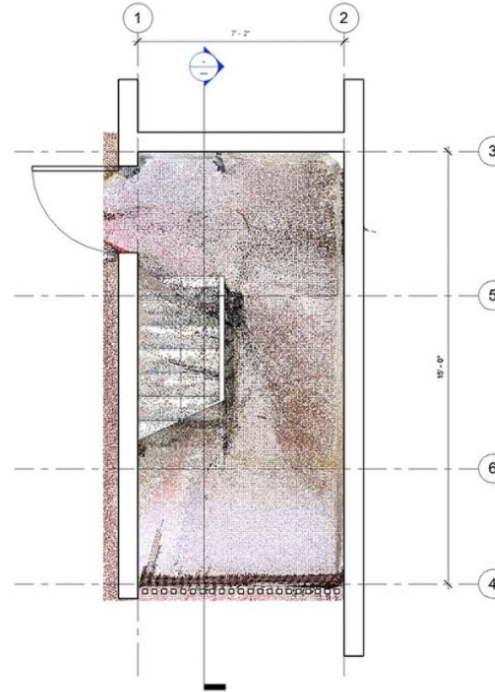
Scan To BIM - Visualization/Design

THANK YOU!

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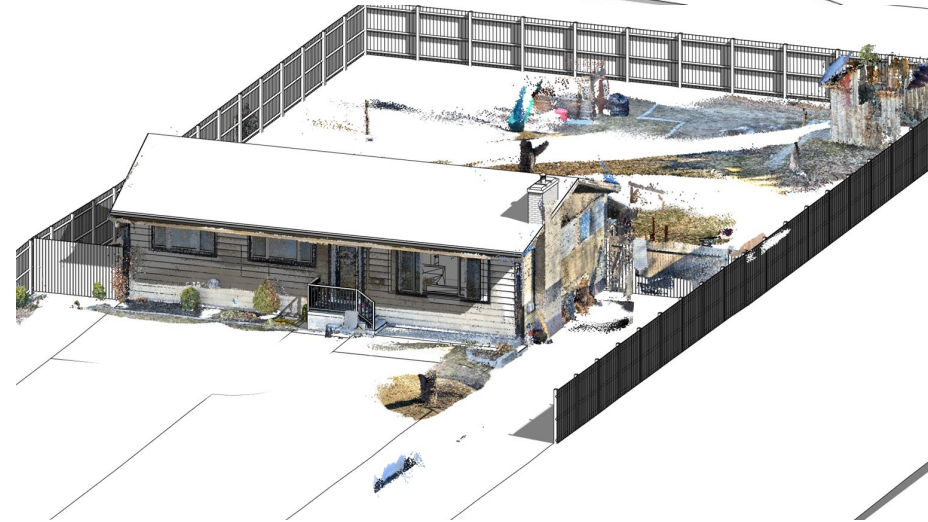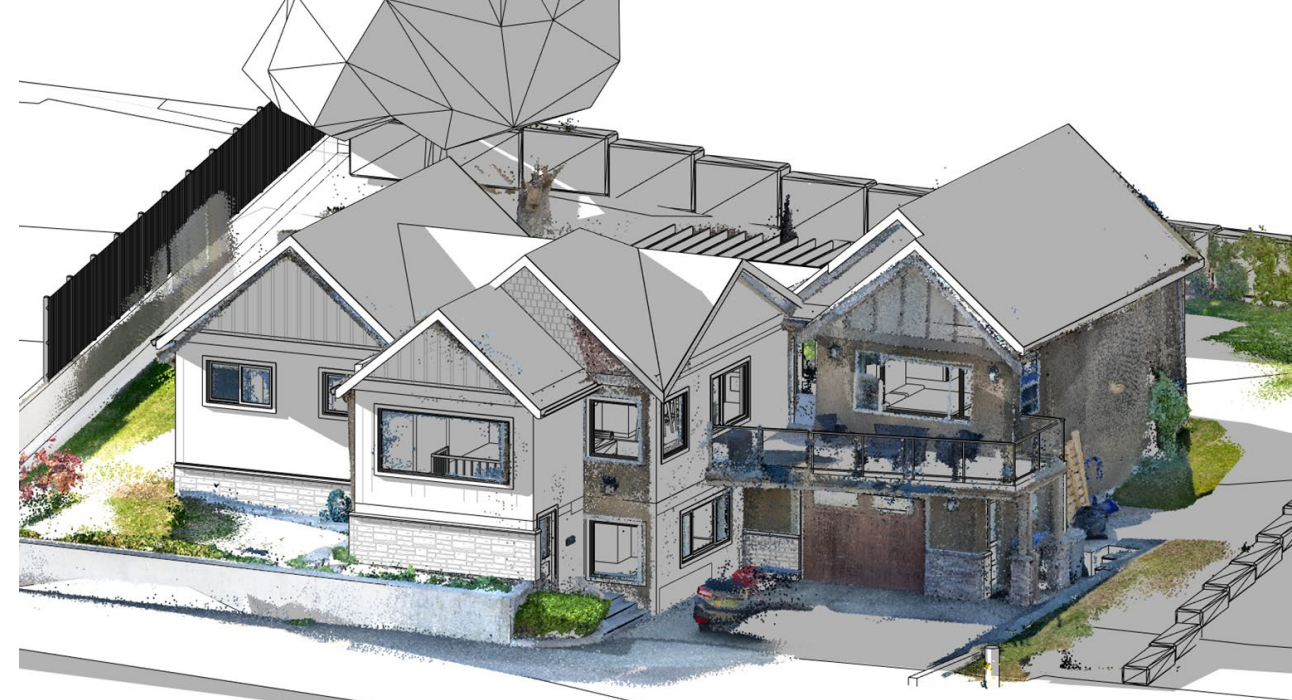
APPENDIX
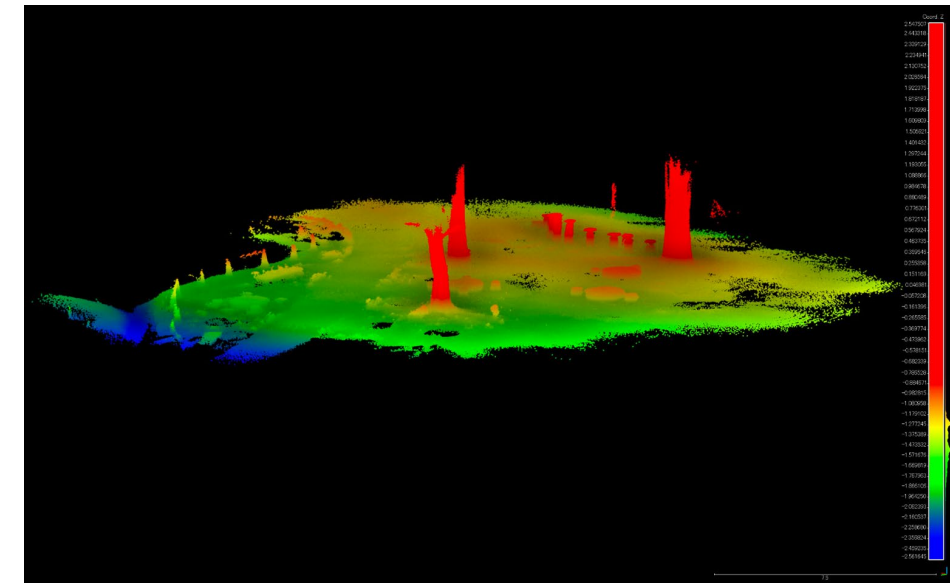
Teakdust Architecture - Capturing Existing Conditions

ProCAD Designs

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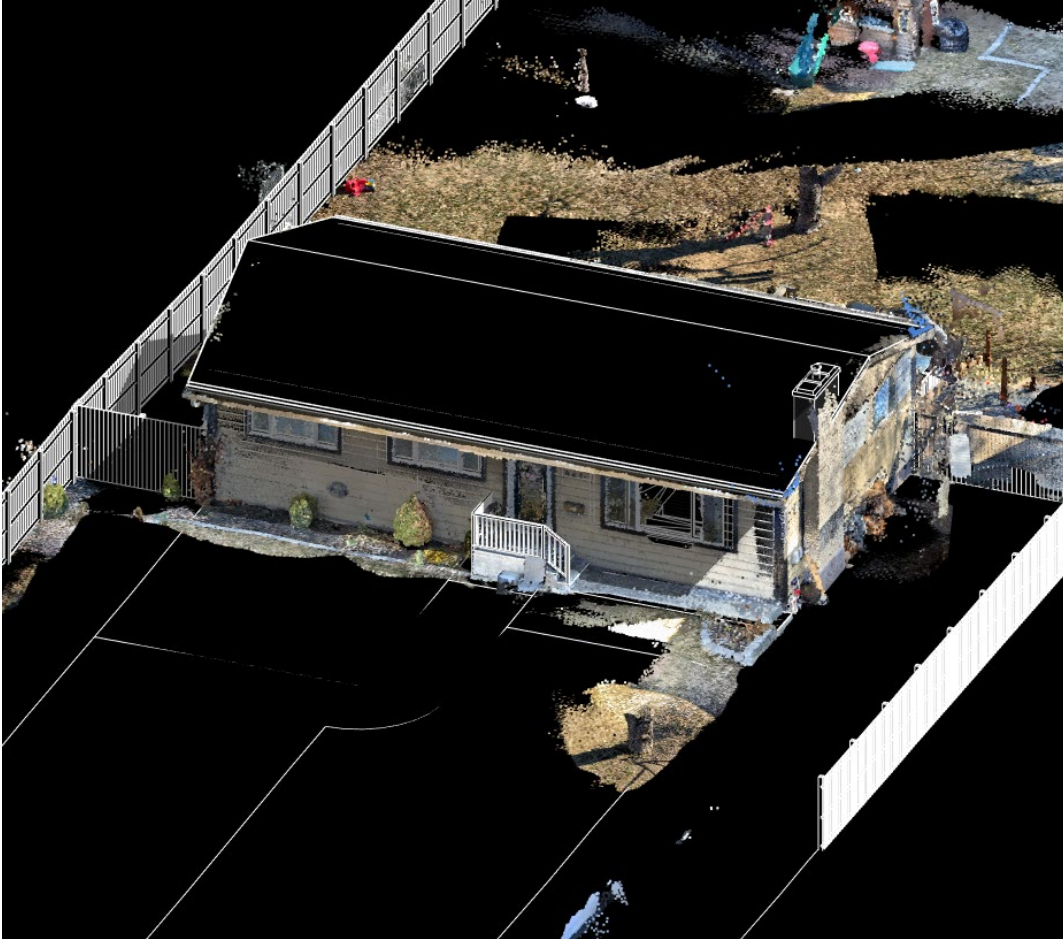
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@O_Hitsuji_san on Twitter
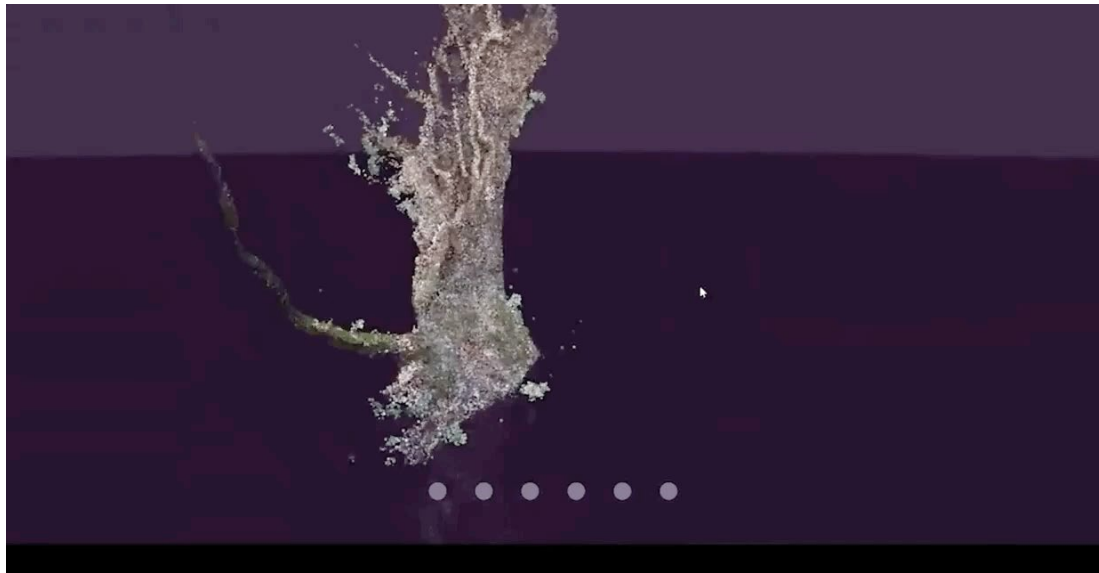

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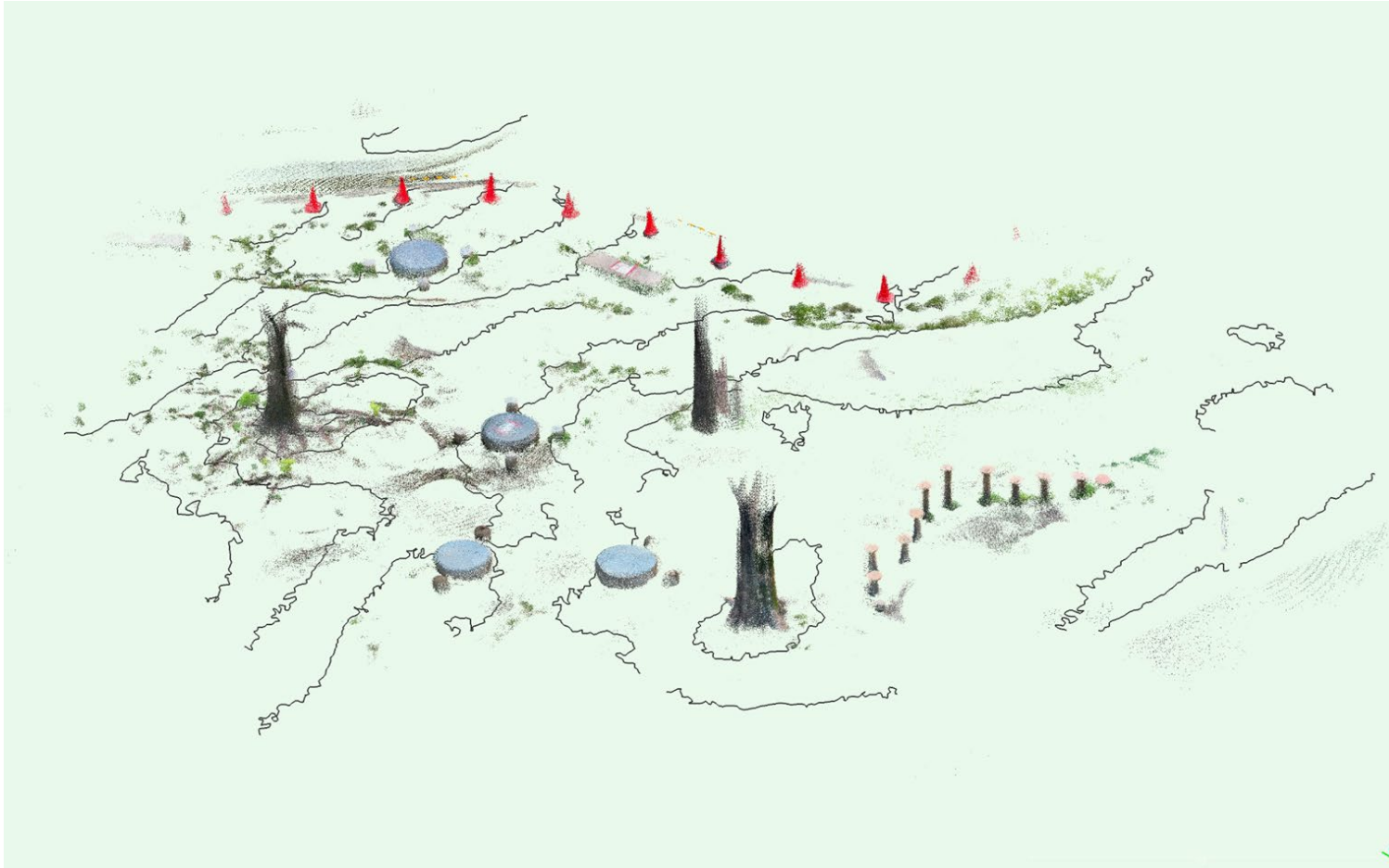
Joseph Azar

@parazar on Twitter

The Falling Acorn - A narrative driven
interactive experience

Tyler Bell

@belltyler on Twitter

Newborn child and delivery room