EinScan-SP Training SOP

Tool Name and Location

The SHINING3D EinScan-SP 3D Scanner is located in Fume Hood #1 in Elings 2448.

Safety

Machine Limitations:

- The turntable has a maximum weight limit of 5kg (~11lbs). Exceeding this weight could damage the machine and its internal components.

Environmental:'

- Keep the scanner in a well ventilated area. Keep flammables, corrosive agents, and liquids away from the scanner. Failing to do so will damage the machine and its internal components.

Physical:

- The projector emits a bright light. Avoid looking directly into the light source to prevent eye injury.

Training

training requirements: Users must attend the in-person training session and should consult the Safe Operating Procedure and EinScan-SP Manual (both found on the Innovation Workshop GauchoSpace page). **Training Outline**

1. Overview of the scanner and the system setup
    1. Structured light projector and dual camera setup
    2. Electronically controlled turntable
    3. Laptop computer
2. Safety
    1. Machine Limit
        1. Do not exceed 5 kg (11 lbs)
    2. Hazards
        1. Keep well ventilated, away from corrosives, liquids, and flammables.
3. Walkthrough of starting up EinScan-S software
    1. File formats, different scan types
    2. EinScan-S menu
4. Scanner Limitations (0.03 mm resolution)
    1. Bigger than 30x30x30 mm, smaller than 250x250x250 mm, less than 5 kg
    2. Do not scan reflective, transparent, or fuzzy objects
    3. Paint or coat dark objects with a light color
5. Step by step walkthrough of a scan
    1. Scanning with the turntable
    2. Scanning without the turntable

    3. Adjusting the brightness and stitching scans
6. Software walkthrough
    1. Turntable toolbar
    2. Scan editing toolbar
    3. Main toolbar (alignment, scans, exporting, brightness)
7. Editing, Meshing, and exporting completed scans

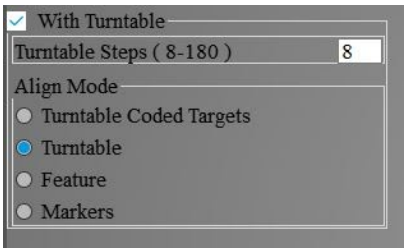
Safe Operation of this Tool

Before Using the Scanner: Make sure that the object:

- Is larger than 30x30x30mm (1.2×1.2×1.2in)
- Is smaller than 250x250x250mm (38x38x38in)
- Weighs less than 5kg (11lbs)
- Isn’t shiny, transparent, or furry
- Has all dark features lightened with a powder or coating

Sequence of Operation:

1. Make sure the scanner is powered on and open the EinScan-S software (on desktop)
2. Select EinScan-SP
3. Under “Choose Working Mode”, select Fixed Scan
4. Select New Scan or Open Scan. Name the file and save to your group’s folder to define the location for saved scan images (saved as .fix_prj file)
5. Select Textured Scan or Non-Textured Scan
    1. Textured scan is used to scan colors and fine features. The user must run a white balance test when using this feature.
6. Adjust Brightness slider  until no red areas are visible on the desired part

Scanning With the Turntable: 

1. Check the Use Turntable box and specify the number of increments (8-180 steps). The Align Mode menu will appear.
2. Under Align Mode, select the desired alignment method
    1. Turntable
    2. Features
    3. Markers (External markers must be placed on the surface of scanned object)

Scanning Without the Turntable:

1. Place the object in the desired orientation within frame of the two cameras

Starting and Editing Scans:

1. Select Start Scan  . Press Pause  or Delete Current Scan Data  if necessry.
2. Use Shift + Left Click and the toolbar to remove any unwanted scan data. Press the Green Check to confirm.
3. Reorient the part and continue to scan until object is fully modeled (Same controls to modify the stitched model)
4. Correct misaligned stitches by selecting Align  and using Shift+Left Click to choose three common points to manually correct the software.

Exporting and Saving the Scan:

1. When the object is fully scanned, select Mesh 
2. Select Watertight to create a closed object file or an Unwatertight model to directly edit the object file
3. After the object has been meshed, specify the desired Simplification Ratio. Make sure that Smooth and Sharpen are both selected. Specify Hole Fill Size if creating an Unwatertight model
4. Select Save  and specify a Scaling Ratio. Save the file as a (.obj .stl .ply .3mf or .asc if you wish to edit the saved mesh)

Editing the Exported File: We do not currently have a universal software solution to edit and modify the generated part files. Please contact the lab staff if you have a solution to this problem. We will continue to research solutions. Meshmixer by Autodesk is so far the most promising mesh file editor, but is not available on lab computers for now.

Detailed Procedure-Step by Step

Supplies: No supplies are necessary to use the EinScan-SP 3D scanner. A blackout enclosure is supplied to prevent light from affecting the scan quality.
Setup:
The default Innovation Workshop setup is to have both the scanning unit and the turntable attached to the scanner stand. Please contact the staff if you wish to try scanning from the tripod instead. The scanning unit and the turntable are both attached to the scanner stand.

The scanning unit:
Contains two cameras and a projector that is capable of projecting both structured and RGB light. The offset cameras provide two perspectives of the same point, allowing the software to calculate depth by comparing the two images. The cameras also capture the distortion of the structured light vertical lines projected over the object surface. This similarly measures the depth and features of the surface. The cameras also superimpose the images taken with Red, Green, and Blue light to create a color accurate 3D model of the object. This color image is combined with the structured light depth scans to create a colored 3D model. The scanning unit can also be removed from the stand and attached to the provided tripod to scan larger objects. The turntable is connected to the scanning unit via USB cable, and the scanning unit is connected to the laptop computer running EinScan-S software via USB cable. The power cable plugged into the scanning unit provides power for both the scanner and the turntable.

The turntable:

Incrementally rotates 360 degrees per scan to capture a complete image of the object. The degrees rotated during each increment are adjustable in the EinScan-S software and range from 2 to 45 degrees. The turntable is controlled and powered via USB connection to the scanner. The surface of the turntable contains coded markers, which are used to reference the position of the object when the scanner is detached from the stand and placed on the provided tripod.