



HP Sprout Pro

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~~REVEAL~~

HP Sprout Pro

Summary

The Sprout G2 is a hardware and software solution in an all-in-one computer. Combining HP hardware with software acquired after taking over [DAVID 3D systems](#). It is the second generation HP Sprout (G2) and includes a 3D sensor for hand-held scanning.

The HP Sprout Pro G2 is an all-in-one computer based solution for:

- 3D scanning
- documentation
- and interactive learning

The HP AU Sprout [site](#) and the HP US Sprout [site](#) contain the official documentation, [educational videos](#) and [case studies](#).

Hardware

- Intel® Core™ i7-7700T
- NVIDIA® GeForce® GTX 960M
- 23.8" diagonal, 10-point touch-enabled, full HD display.
- Full HD projector
- RGB-D sensor (rgb640 x 480 @30fps - depth 640 x 480 @30fps)
- 14 MP Webcam
- 21.3" diagonal Touch Mat
 - 2048 levels of pressure sensitivity
 - 20-point capacitive surface
- Active pen

Use in the Fabrication Lab

- The sprout main use in the Fabrication Lab is for 3D scanning.
- Objects that range from approx
 - minimum 50 x 50 x 50mm mm to
 - maximum trapezoid dimensions of a base of 210 x 290mm, height 200mm, top of 100 x 150mm¹⁾ can be scanned.
- The Sprout has two separate scanning systems - SLAM Fusion and structured light.

Basic Scanning Considerations

Due to the limitations of non-contact light scanning, objects must be:

- opaque,
- not reflective
- not translucent
- no sub-surface scattering
- not too dark
- not too light

Which Sprout Scanning Technology to use?

Choosing the whether to use the SLAM fusion or Structured Light scanning depends on the size of your object, the quality of your desired result and your physical capabilities (and patience!).

- If your object is large enough and you want a quick result that covers all surfaces and is pre-textured, use the 3D SLAM fusion method.
- If your object is less than 100 x 100x 100mm then the 3D SLAM sensor will probably not detect it at all, and structured light is your only option.
- If you have difficulty holding your object steady for 5-10min inside the sprout scanning area, then use the structured light method.
- For all other objects, use the structured light method.

Output file format

If your model requires more processing or you want to retain colour information, export as an OBJ file. If your model is nearly ready to print then use the STL format.

SLAM Fusion Scanning

- The Sprout uses 3D depth sensor²⁾ combined with a high resolution webcam.
- It is controlled using the 3D Scanner software, and is operated by manually rotating your object with your hands in front of the sensor.
- Depth (3D) information is captured by the depth sensor, and the webcam is used to map high quality textures onto the model.
- Check out the video on the [HP Z 3D Camera](#) - this is for the stand-alone version of this system.

Important Notes

The depth sensor works best with interference from outside light sources, this is why we have the sprout inside a small photo booth.

Before you start

- Check with the Fabrication Lab supervisor whether the sprout has been used or calibrated recently.
- Turn on the Sprout.
- Log in as edgeuser (password edgeuser)
- Close up the sides of the photobooth (leave the front and the vent on the top open)

Scanning - Prep

- Launch 3D Camera app
- Turn on lamp on app
- Check the size of your object inside the green ring (will it scan?)
- start with the object on its longest side or base (remember this orientation!)
- Click the camera icon to start

Scanning

The aim here is to capture an entire scan of your object, without your fingers or hands mapped as textures or parts of the model.

- Hold the object in the tips of your fingers, starting underneath
- Start rotating the object
- if you lose tracking
 - go back to the last position
 - go back to the start orientation
- Rotate the object around one axis at time
- lift the object closer to the scanner to get more details
- Click the tick when done

Texturing

Texturing is done using the high resolution webcam. This is done without your hands in the frame!

Start with the object in the start orientation

Structured Light

The Sprout uses a built in projector, touchmat and web camera. The software used is [HP 3D scan V5](#) originally designed for stand alone scanners and cameras and developed by DAVID Laserscanners. There is a wealth on information in the original DAVID forums both on [structured light](#) and the [Shape Fusion app](#).

Important Notes

Carefully read all of the following safety precautions before using Sprout 2D calibration, 3D calibration, and 3D Capture scans.

WARNING! -- Photosensitive Epileptic Seizures

A very small percentage of individuals may experience a seizure or other complications when exposed to certain visual images, including flashing lights or patterns that may appear during Sprout 2D and 3D calibration, and/or 3D Capture scans.

If you, or any user, have a history of seizures or epilepsy, consult a physician before using Sprout calibration or 3D Capture scan functionality. Even those without a personal family history of epilepsy or stroke may have an undiagnosed condition that can cause photosensitive epileptic seizures.

If you experience any of the following symptoms, immediately stop using Sprout calibration or 3D scanning functionality and consult a physician:

- Altered vision
- Light-headedness
- Dizziness
- Involuntary movements such as eye or muscle twitching
- Nausea
- Convulsions
- Loss of awareness
- Confusion
- Cramps
- Disorientation

Resume Sprout usage only on approval of your physician

Parents should monitor and ask their children if they have any of the above symptoms. Children and teenagers may be more likely than adults to experience these symptoms.

The vision of young children (especially children under the age of 6) is still under development.

Consult your physician (such as a pediatrician or eye doctor) before allowing young children to use Sprout calibration or scanning functionality.

To help reduce the likelihood of adverse physical reactions:

- Use in a well-lit area and do not look directly at Sprout or light patterns generated by Sprout

during calibration or 3D scans.

- Avoid prolonged use of the 3D scanning process.
- Take a 15-minute break during each hour of Sprout use.
- The length and frequency of necessary breaks may vary from person to person.
- Please take breaks that are long enough to allow any feelings of discomfort to subside.
- If symptoms persist, consult a physician.
- Avoid calibrating Sprout or producing 3D scans when you are tired or need sleep

Before you start

- Ask the Fabrication Lab Supervisor if the Sprout has been used today or recently calibrated.
- The sprout structured light scanning works best with some ambient (non-direct) lighting. Open up the sides (not the top) of the photobooth before you start to scan.
- Check with the Fabrication Lab supervisor whether the sprout has been used or calibrated recently.
- Turn on the Sprout.
- Log in as edgeuser (password edgeuser)
- Close up the sides of the photobooth (leave the front and the vent on the top open)

Preparation

Dark Objects

- Set the Projector Brightness slider to maximum.
- Place the dark object in front of the scanner, and adjust the exposure until red sine waves are correct on the dark object.
- For background the image is now too bright because the calibration panels are white - this cannot be helped ³⁾

Waves in Scan

CAUSES

You seem to be using custom hardware components (mainly cameras, lenses), so you might experience the following effects that do not happen with original DAVID SLS / HP 3D Structured Light Scanner hardware:

1. camera exposure time not perfectly synced with projector
2. camera can see the single pixels of the projector and the black lines inbetween (or the diamond pixel structure) because it has a too short distance to object and/or too large focal length and/or too high resolution
3. ... various bad things when settings are wrong or hardware is low quality ... Furthermore, there are causes that can happen with custom hardware but also with original DAVID / HP hardware:
4. Bad settings in the projector "color" menu (brightness, contrast) -> should be default, usually

50%

5. Bad settings in the projector image / aspect ratio settings -> Aspect ratio should be "auto" or "full"
6. Wrong setting of projector resolution -> should be the native resolution, which is usually 1280*800
7. Similar wrong settings like (4)-(6) in the graphics card filters for the projector
8. Bad settings in the projector image / keystone settings -> "Auto" must be off, "manual" must be 0
9. Flickering environment light
10. Moving scanner or object, e.g. breathing person when scanning their chest

SYMPTOMS

Generally it's helpful to look at the DIRECTION of the waves. When scanning with "horizontal" pattern orientation (standard for SLS), are the waves

1. parallel to the projected vertical stripes, or
2. grid-shaped / squared / checkered (i.e., horizontal and vertical waves) like in Post #2
3. something else

SOLUTIONS

- (1) needs to be fixed! When you look at the live camera image before you click "Start", the red intensity curves should not move up and down (or as little as possible). Otherwise will cause problem (a).
- (2) can cause problem (b). It can help to reduce focus of camera or projector, but you should reduce the focus of the projector only. Reducing the focus of the camera will destroy small details in the scan. Calibrate again after changing the focus.
- (4) (5) (6) (7) can cause problem (a) and can be easily fixed by choosing the right settings.
- (8) will create very typical curved artifacts, not parallel waves. Be sure to switch keystone correction off.
- (9) and (10) can usually be avoided easily.

SCAN RESULT PARAMETERS

- Smooth: When you use professional hardware, you should not need this. It covers noise and waves. It cures the symptoms but not the cause. It may be acceptable for some objects that do not have important fine details anyway. I suggest to keep it at 0.
- Quality Check: Removes some "probably imprecise" data, but has no influence on noise and waves.
- Outlier Removal: Removes outliers, but has no influence on noise and waves.

COMPUTER HARDWARE

- Computer speed should not make a difference in scan quality.
- Different computers (mainly graphics cards) may have different projector frame rates (59.9 Hz, 60.001 Hz...) and that difference might be visible in some custom hardware setups, I'm not sure. I haven't seen that problem with original hardware. (?)

TEST SCANNING THE CALIBRATION PANELS

Please don't overestimate scanning the calibration panels.

- When scanning the calibration corner or some other, slightly reflective concave corner, you will often experience some waves parallel to the corner edge, caused by light reflection from one panel to the other. Those waves are strongest in the corner and fade out to the left and right side. Don't worry about those, you usually won't see them when scanning a real object.
- Scans will always have a little noise. Every real-life sensor has some noise. When you zoom close enough you will always find something. The 3D viewer in our software can make the smallest waves/noise visible and appear stronger than they are. So please scan a real object and then decide whether the result is good enough or not. :slightly_smiling_face:
- And don't forget that the Fusion will also reduce outliers and noise a bit.
- Start with 60hz on projector, 1/60 on camera, then fine tune:
- Adjust frequency on camera to have the less possible waves moving through the screen in live view.
- Adjust frequency of projector using graphic card if possible to better fine tune the adjustment.
- If using Acer K132 (or 135), do not use at full brightness (my personal experience).
- Start by scanning still items with a mat surface

1)

these measurements are based on our experience in use, not HP documentation

2)

[Orbbec Astra S sensor](#)

3)

a darker surface on the touch mat may help - ask the Fabrication Lab supervisor to assist