MASTERING MOBILE 3D SCANNING

How to Capture Interior Spaces for As-Built Documentation
A Step-by-Step Guide

MEDIATASK + DOT PRODUCT

Introduction

Mobile 3D scanning is here to stay.

This new technology already has many advantages over traditional surveying methods. Although still not perfect, if used correctly it will make your job easier and save you a lot of valuable time.

About this guide

This manual will help you quickly learn how to use an iPad or an iPhone as a 3D scanner to capture a property accurately, regardless of its size. We'll show you how to prepare, explain the scanning process step by step, and guide you through the options for processing your scan and sending it for drafting and reporting work

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This guide was created by **Mediatask**, a drafting and reporting company that specializes in utilizing cutting-edge reality capture technology combined with the expertise and talent of our drafting engineers. The content is based on numerous field tests and feedback from our clients, whom we have assisted in adopting 3D scanning technology.

Mediatask's offering includes floor plans, CAD & BIM models, area measurement reports (e.g. NEN2580, ANSI Z765, BOMA), and more.
For more information visit us at mediatask.co.

DotProduct develops high-performance, easy-to-use solutions for capturing 3D spatial data for documentation of the built and existing world. Our technology is designed for mobile professionals who need high-quality 3D data, instantly. Our Dot3D software delivers accurate, mobile 3D scanning capabilities on iOS, Windows, and Android devices, turning your phones and tablets into versatile professional-grade 3D-capture and processing solutions.

Learn more about DotProduct and Dot3D at dotproduct3d.com

Contents of this guide:

Let's get started!

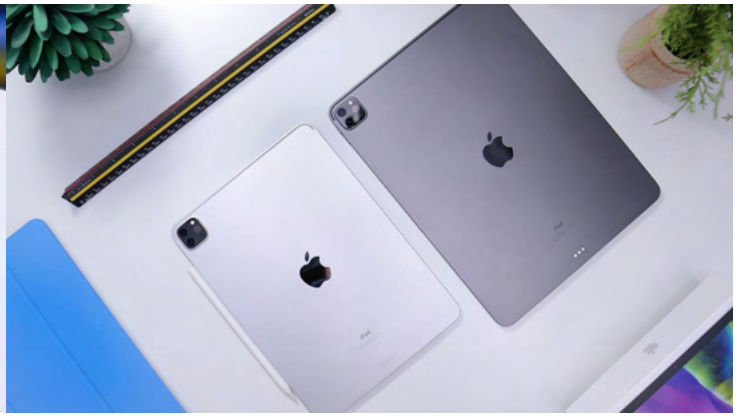
Prep like a Pro

Hardware

You'll need an iPad or iPhone with a LiDAR sensor. If you're unsure if your device has it, look for a 5mm black circle near the rear cameras or check your specs.

Here's a list of compatible devices:

- All iPad Pro 4th-generation (2020) and newer
- All iPhone Pro or Pro Max models, generation 12 or newer



We recommend using an iPad because of the sturdier grip, bigger screen, and better heat dissipation (scanning is hard work for your device!), but you'll also be able to make a perfect capture with an iPhone. A gimbal is a good option when scanning with a phone.

A heavy-duty case is a good idea:
You will be walking with your device and moving it around a lot so it's important to have it well-protected with a robust case with a good grip. A „pro" case will also make a good impression on the client or homeowner.

One caveat

Make sure your case doesn't trap the heat dissipated from the device. If you notice your device is getting too warm it is better to take the case off. Overheating can slow down performance but also lead to instability and inaccuracy due to the deformation of the optical elements.

Tags

To get the most precise results we cannot rely on the device's sensors alone. After all, it's smart but it's only a phone!
Dot3D recognizes AprilTag targets. For a quick start, you can download and print them on a regular printer and use painter's tape to safely attach them to a wall. Make sure not to occlude the black printed area with the tape.

***A sturdier solution**: Mediatask provides a starter kit containing 28 targets printed on a lightweight gator board with blue-tack on the backside for easy mounting on and off the wall. The surface is laminated with a matte finish for durability and good detection at all viewing angles.*

In the "place tags" section we'll show you how to properly set up these tags, use your laser measure to grab reference dimensions between them, and input them into the app.

Other tools

A laser measure tool will be essential for inputting additional known dimensions, so *take your Disto with you*. Versions with the end piece are most recommended as they will allow you to make even more precise measurements between the centers of the tags even at an angle.

It is handy to have a tape measure, especially when the only option is to measure between tags placed on the floor.

Software

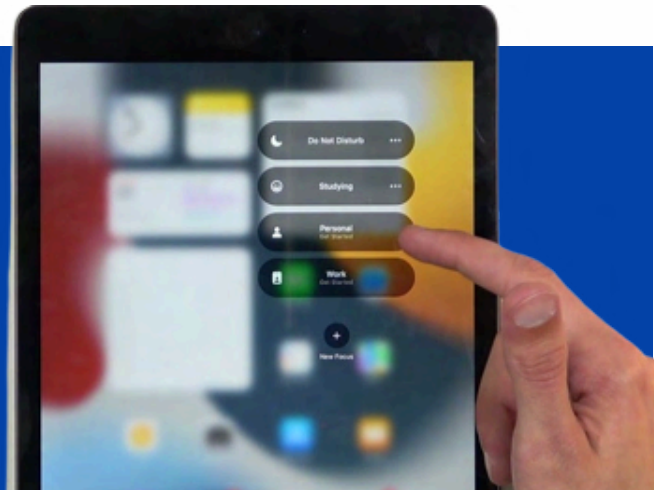
To make the scan you'll *need to have Dot3D installed on your device*. There are many apps in the market and we have tested them all. Dot3D is precisely tailored for your use case: it will be very easy and handy to use with scanning interiors and the data will be at least as precise as your hand measurements.

The app is constantly improving so make sure you periodically check if you have the latest version installed.

Checklist

- ○ Have your device charged
- ○ Cameras and sensors cleaned
- ○ Tags
- ○ Disto
- ○ Tape measure
- ○ Turn on „do not disturb" mode*****
- ○ Charger and / or power bank
- ○ Dot3D installed

* Receiving a call or clicking on a system notification will interrupt your scan. Dot3D enables you to recover it and continue, but we highly recommend to always turn on the "Do not disturb" mode on your device before scanning.



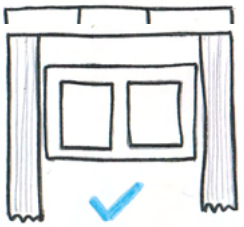
Scanning Step-by-step

1. Plan and prepare your route

***This is a crucial step*.** Go through the entire property to get a sense of space, and connections between rooms to make a mental map of the space.

Think of it as a test run: try to make yourself aware of the potential obstacles you will encounter while making the scan.

While making this walk open all doors, if possible in such a way that you **won't need to move them later.** If you can, use door stoppers to fix doors in place. ⚠️ Moving doors during the scan can confuse the algorithm and lead to errors in 3D reconstruction.



Open some cabinets and fixed wardrobes so that the scan will show the true depth of a room.

It is a good idea to open window curtains at this point to make sure window edges are visible. This will make scanning them easier and more precise. While scanning windows remember to **keep your distance** - if you get too close the camera will not be able to track its position by the outside scope alone.

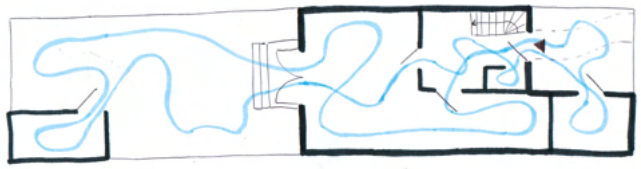
Important!

Plan your route in such a way that you finish your scan in the place you started.

When scanning multi-story buildings we recommend that you:

- Scan the base level, starting at the staircase area, scanning all the rooms, and then returning to the staircase area
- Walk up the staircase and do the same thing for the 1st floor
- Repeat until all floors are captured,
- Continue the capture while descending the stairs until you reach the starting area
- Make sure to have a fair amount of overlap around the start/end point

If scanned properly, the staircase will provide a very good connection between the scans of the different floors. It is very important to place tags on each floor near the staircase and to capture those tags when doing the loop on each floor and when ascending and descending the stairs. You'll find more information about tag placement and usage in the next section. Include exterior spaces and structures (terraces, gardens, sheds, guesthouses, etc.) in the scan of the ground floor (but remember to close the loop and return to the starting position).



2. Place tags

While preparing the route, strategically place AprilTag targets: make sure to place **at least 4 targets on each floor,** which will allow you to check two dimensions. Ideally, these should be *the two longest dimensions in perpendicular directions*, for example, the width and length of the entire floor. It will not always be possible to place two tags along the total length or width of a floor. That's OK. Place the tags in the biggest room or in a way that will allow you to grab a long dimension.

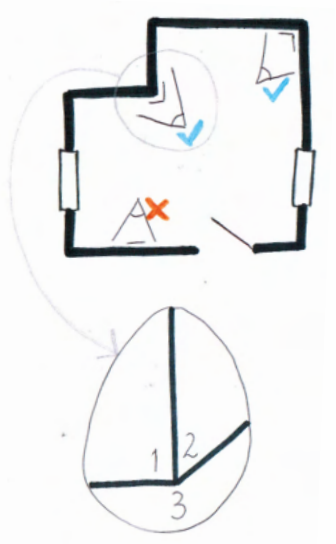
Remember to take dimensions in perpendicular directions

It is advised to put additional tags in areas that will be visited more than once, like a hallway or staircase. These won't necessarily be used for dimensional constraints, but the software will recognize their location and use it to correct the overall geometry of the scan, in result producing a more faithful 3D representation of the space.
You can, of course, put more tags and capture more than two dimensions per floor if you have the time for the setup. You should avoid placing tags closer than 2 meters apart.

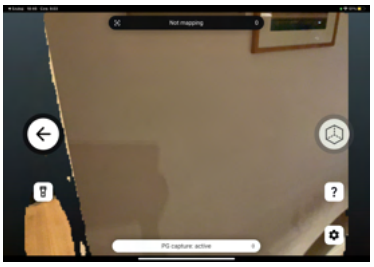
Important!

Never place tags on doors or any other movable objects. Make sure the tag is securely attached to the surface.

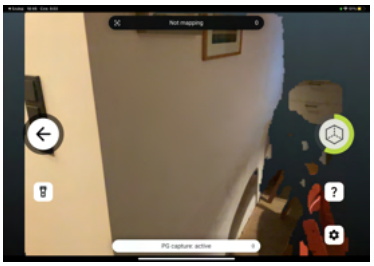
3. Choose a starting point



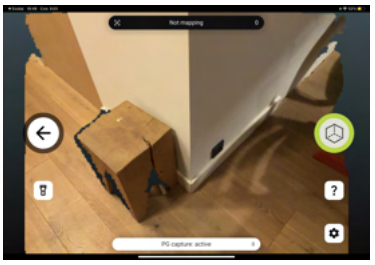
You should start and end your scan in the same place. This is to ensure that the software can perform „loop closure" - a way to correct the little scanning errors that accumulate throughout the scan. The starting point should also have a good depth variance - you should definitely **avoid starting pointing at a blank wall**.
As a rule of thumb, the best place to start/end a scan is a corner, i.e. where 3 perpendicular (or even just roughly perpendicular) planes meet. It doesn't matter if there's furniture in view.
The best position to start/end is to position yourself in the "angular center" of the corner, in other words: try to place the corner in the center of your camera's field of view.



***very bad** starting point - not enough planes detected, no detail visible*



… two walls visible, icon starts turning green, but still not there yet…



***good starting point** - we're at the center of the angle and catch the floor surface also*

Pro-tip

The green circle around the start button will indicate if the area has enough distinct features for the camera tracking to work properly.

4. Scan the floor room by room

Try to capture the entire room, including the surface of the floor. Move around the room and proceed to the next one.
Try *not to leave too many gaps*.

Leaving too many unscanned areas might make it difficult or impossible to figure out the proper room structure or use. Try to capture the entirety of the space, including the floors.

5. Missed a spot? Append.

If after completing your scan you look at the preview and notice a missing room or a part of a space use the append option to attach additional scan data.

Just hit the „Scan/Append" button on the toolbar and choose a frame from the list of thumbnails, which represent the places where you can resume the capture. You can only do this in a spot that you have scanned previously. Then the app will display a semi-transparent overlay showing the photo snapshot of the chosen frame. Move your device so that you are aiming roughly at the same place, Dot3D will automatically recognize it when you're close enough and resume scanning immediately.

Important!

Appending to a scan ***can only be done in the „raw scan" stage, before*** the Optimization step (see below).

Best practice for the highest accuracy

For optimum results follow these general guidelines:

1. Avoid moving doors (at all cost)

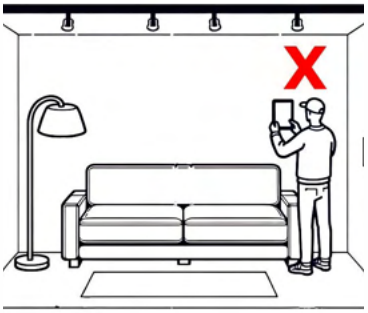
Moving objects while scanning is one of the single *most impactful causes of errors* of mobile 3D scans. When capturing building interiors, the most common example of moving objects are… **doors**.
You must use them to get around the place, but you should not move them during scanning. This might pose a challenge, especially in small and cramped spaces, but with a bit of practice you'll be able to strike a balance.

Remember to:

- Open all the doors in your space before starting the scan. If possible, fix them in place with door-stoppers.

- Do not open or close any doors during the entire scanning process! This also includes cabinet doors and moving objects in general

- If you notice a door was accidentally nudged or moved during the scan (or there was no other way to get in and out of a tight space) try your best to *avoid scanning the door again*. It is better to leave a gap in the scan in that area, rather than having a big break of continuity.



2. Keep a good distance from objects

- Try to stay within 2-3 meters of distance from the walls. Of course, you can get closer if detail is needed on a particular spot. However scanning large stretches at close ranges (below 2 meters, especially. below 1.5 meters) can lead to overall subpar results due to drift accumulation.

- A good rule of thumb is to treat walls as if they were mildly radioactive. You should *stay at a safe distance*. You can get closer but only for short periods,

- Keep an even greater distance from **white walls**, as they can confuse the device's self-positioning system by robbing it of visual signals. This can be really bad for overall accuracy. If the space contains a lot of untextured/uncovered white walls, it's particularly important not to scan them up close. *White walls are best captured from a 3-4 meter distance.* The goal is to get as much surrounding floor/ceiling/other walls into the field of view as possible,

- In case of empty spaces with blank walls, it's a good practice to get some "stuff" into the room: boxes, posters, or anything with geometry and/or texture. AprilTags on white walls will help tremendously with providing anchor points for the scanner app,

- When moving through hallways, it’s best to face the direction of the hallway and at a 45 angle toward the floor, to get good LiDAR depth coverage. Avoid facing the side walls when moving through a hallway.

3. Special situations

- *Avoid scanning mirrors* - just scan around them.
- Use the app's built-in flash when scanning in dark spaces or corners (but remember to turn it off later to save battery!)
- In case of very small rooms (toilets, storage cabinets, walk-in closets) it is recommended to roughly scan the interior without going inside. The scan will have some small gaps in the result, but that is OK. Moving around too much in small spaces could sacrifice the overall accuracy of the entire scan.

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4. Scanning path & movement

- Remember to always close the loop.
- Capture tags. When *near a tag - capture it again*. This is especially important when closing a loop! Note that the app will indicate when it recognizes a tag by highlighting it with a yellow square.
- Keep your movement steady, and avoid sudden changes of direction or rotation. Use fluid motion, and avoid shaking or moving the device too fast, this can break the continuity of the scan.

Pro-tip 1

Dot3D captures 3D points in „bursts" every time the app detects a significant change in the geometry overlap. Occasionally, the device might need a longer time to notice your movement. In these cases you can **trigger additional collection bursts manually** by tapping anywhere on the screen, other than on the action buttons. This way you can easily and quickly fill in the gaps in the scan without extending the scanning path and moving the device too much.

Pro-tip 2

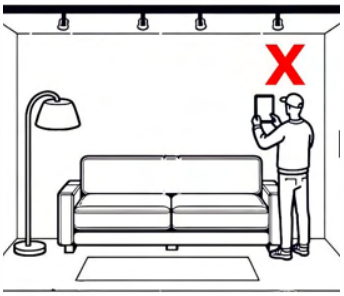
You can scan the interior and exterior of a property in one single scan. To get the best results, place AprilTags near the doorway leading out and on the sides of the windows which will be possible to **detect both from the inside and outside**. These extra tags will serve as „anchors" between the two parts of the scan and vastly improve the alignment.

Fundamental scanning tips recap

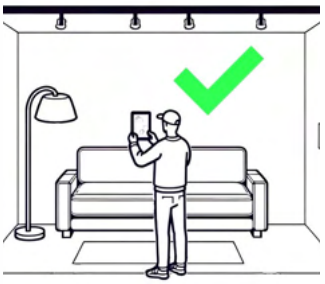
Do not open or close any doors during the entire scanning process!
Doors must stay in one position.

Instead, open - and fix in place - all the doors in your space before starting the scan.

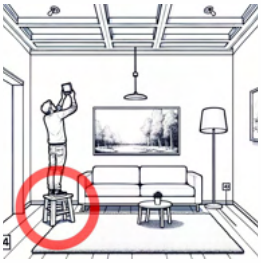
⚠ If you notice a door was accidentally nudged or moved during the scan try your best to avoid scanning it again.



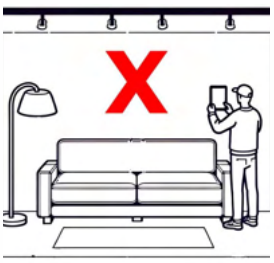
Do not stand close to walls while facing them. Scanning walls up close deprives the camera of seeing important visual context.



Instead, position yourself with a good amount of distance to the walls. Get texture or geometry in the camera's field-of-view.

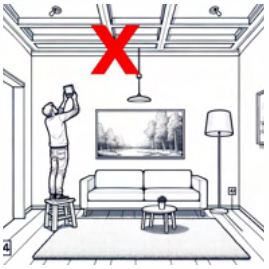


Stay safe!
Watch your step and always stand on solid ground while scanning.



Avoid scanning over blank areas (such as blank walls)

Avoid scanning up close to objects, walls, furniture unless you truly need the detail.



Avoid scanning ceilings unless you really need them in the model.
(but **do include** some parts of the ceiling near the walls)

These tips can be accessed in the Dot3D app from the scanning screen by hitting the "?" icon.

Adding photos and annotations to the scan

The Dot3D app lets you grab HD photos while you are capturing the scan. *This can be done both manually and automatically.*

Manual photo collection

It is a good idea to make photo snapshots in areas of interest, that are important but can be not clearly visible in the 3D scan alone, e.g. an HVAC unit or cellar trap door.

To create a photo annotation simply click on the camera icon while making the scan.

These photos are saved with the point cloud data and can be later accessed along with their location.

Automatic photo collection

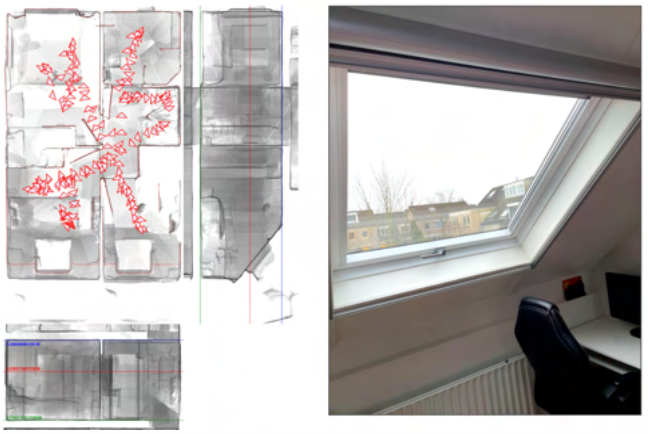
You may also set your device to take photos automatically:

- Go to “Settings > Scene Capture > NeRF Settings”
- check „Enable NeRF/PG Capture”
- set „Frame Spacing” to „100”.

This needs to be done just once. The app then remembers these settings and the photos are collected for all subsequent scans.

The exported point cloud contains these photos (collected manually and automatically) and their location and orientation in space.

This feature proves useful when creating as-built documentation - correctly placed photos can clarify unclear areas of the scan.



Right: Mediatask’s software lets drafters quickly and contextually access all photos by hovering on the scan section.

You can also add custom **Annotations** to your scan - just press and hold the photo icon while scanning and choose the crosshair icon. Later on, you can input additional text information, if needed. This can be handy for adding important information that is not clearly visible on the scan, such as the location of specific equipment (e.g. boiler or HVAC unit)

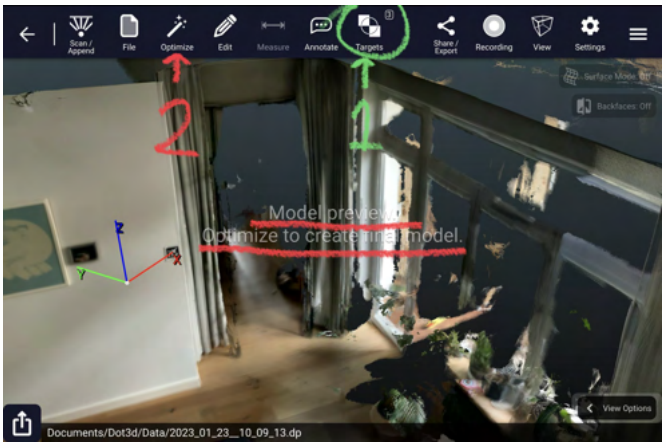
Adding dimensions and optimizing the scan

After completing the scan, you will see an overlay text *„Model preview. Optimize to create the final model”.*

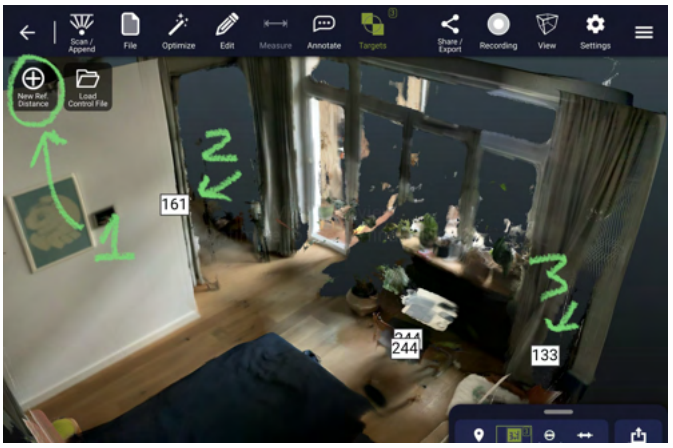
Important!

Before you proceed to Optimize, you should input the dimensional constraints first. It will not be possible to do this after the optimization process.

To input measurements, click the *„Targets” button* on the menu. This will display a view of your capture with a number near each recognized tag. Choose *„New Ref. Distance” (1)* and then

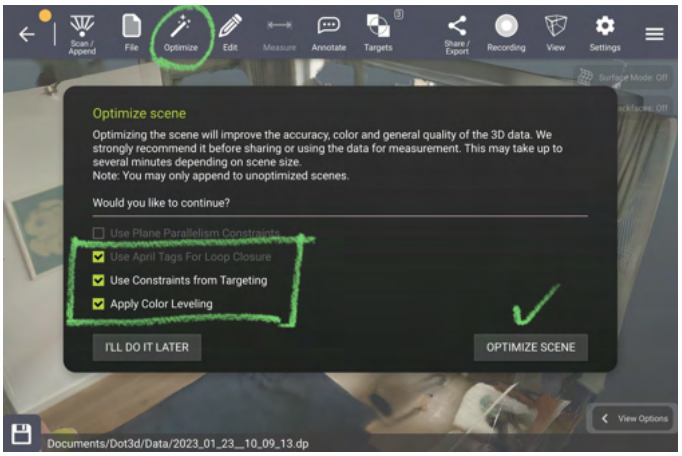


press on two tags *(2) (3)* to specify which distance you want to input.



Measure the distance between two tags with a laser distance meter and input the value into the pop-up window. **Be mindful that the app's default units might vary from the units on your laser measure.** You can change this setting in Dot3D.

Repeat this process for all the dimensions in your scan. At this stage, it is good practice to make sure all dimensions are properly placed.
Once you're done you can hit the „Optimize" button in the toolbar:



Optimizing is done entirely on the device and *is a crucial step that ensures maximum accuracy* of the data captured.

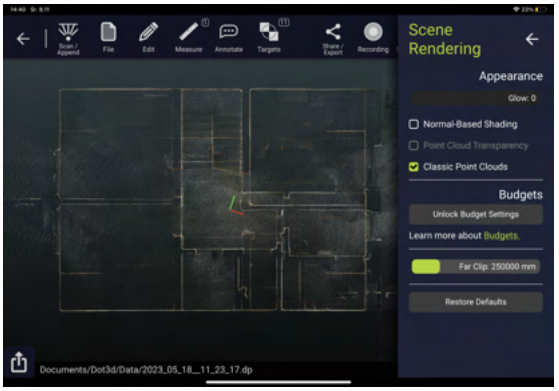
By providing Dot3D with reference measurements the app can adjust the point cloud in a way that known dimensions are preserved and **overall accuracy is improved**. Additionally, the AprilTags used for the dimensional constraints, as well as any additional ones present in the scan serve the important purpose of identifying the fixed reference points in space - this is used for the „**loop closure**" algorithm which makes sure there are no shifts or breaks in the point cloud.

Review your scan

You're almost there, but we strongly recommend that you always perform a *visual inspection of your scan before exporting it.* Choose the top-down view and switch to orthographic mode. In this view, errors or problems are immediately more apparent than in the perspective view. Check for:

1. Overall structural integrity:
   There should not be any major breaks or misalignments visible in a properly optimized scan.

   💡 **Pro-tip:** For additional clarity, use the "Classic Point Clouds" option in the "Scene Rendering" settings. It is a more transparent view, which is especially useful for checking the alignment between two or more floors present in the scan.



2. If the scan is properly oriented with regard to the vertical axis:

✔️ *Top-down view: proper orientation - floors are horizontal.*

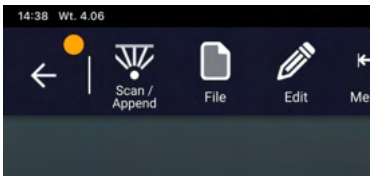
❌ *If your scan appears rotated in the top-down view, you need to fix its orientation.*

In the top-down view, the scan should look like a floor plan. On the rare occasion of a rotated scan, please adjust the coordinate system as described in **Example 4** below.

3. if the scan has been optimized and the dimensional constraints were entered:
   In an already optimized scan you won't see the "Optimize" button in the top toolbar.
   Next, click on "Targets".
   Blue lines should be visible for the dimensional constraints that you have put in.

Saving and exporting

Your scans are stored by default in the ***Dot3D / Data*** folder on your device, but you should make sure that you save any changes made before exiting the app.



Unsaved changes will be indicated by an orange dot in the top left corner.
Choose **File > Save** to save changes. The app will also prompt you to do so if you try to go back to the dashboard.

Dot3D lets you export the pointcloud in a variety of popular formats including pts, ply, and e57. The native **.dp** format is recommended as it is lightweight and contains all the additional data such as photos, annotations and control measurements. The format can be imported into the most popular software, ranging from Autodesk Recap to CloudCompare (full list here Dot3D workflows).

You also have the option to share the file directly with online storage apps e.g. Dropbox using the Share/Export feature.

Uploading to Mediatask

If you're a Mediatask customer you can attach your scan(s) to an order for floor plan creation or area measurement reports.

Simply upload the **.dp** file(s) to the "pointclouds" folder.*

The point cloud will be automatically pre-processed at this point. Within a minute you will see its preview in the "Additional" folder, with each floor separate as a backdrop reference for drafting.

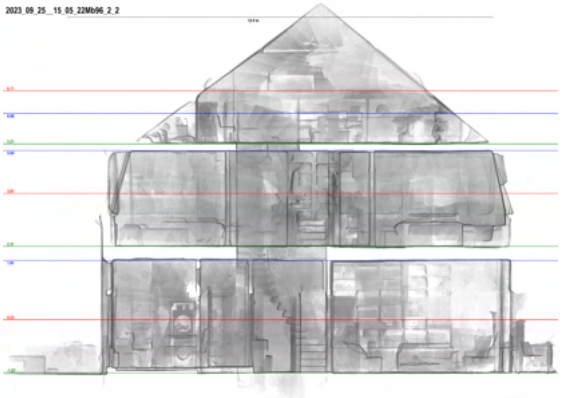
*Alternatively you can paste a Dropbox or Google Drive link in the "pointclouds link" field.
⚠ If you choose this option please make sure that the link points to a specific file (**not a folder**) and that the "**shared to anyone with link**" option is turned on.

Downstream Workflows

(a glimpse of how we make the most out of 3D scan data at Mediatask)

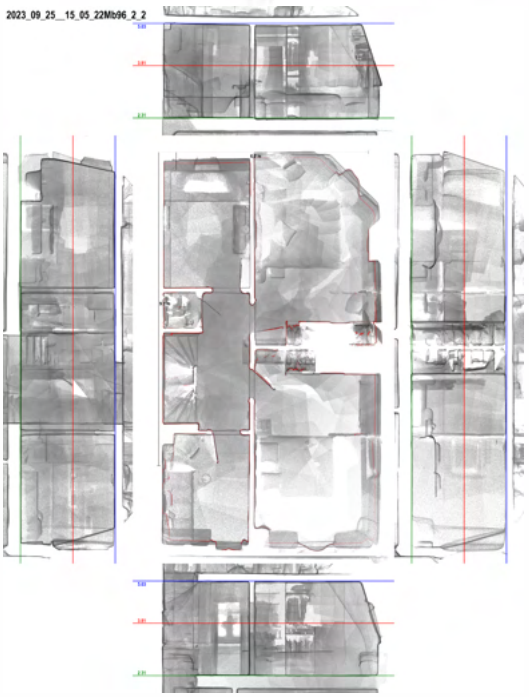
The *automatically generated sections* processed by Mediatask's proprietary software are meant mainly for our drafters, but we invite our clients to inspect these images, as they show in a clear and understandable way the structure of the building and can serve as a way to double-check your work and input additional comments, useful for our drafters.

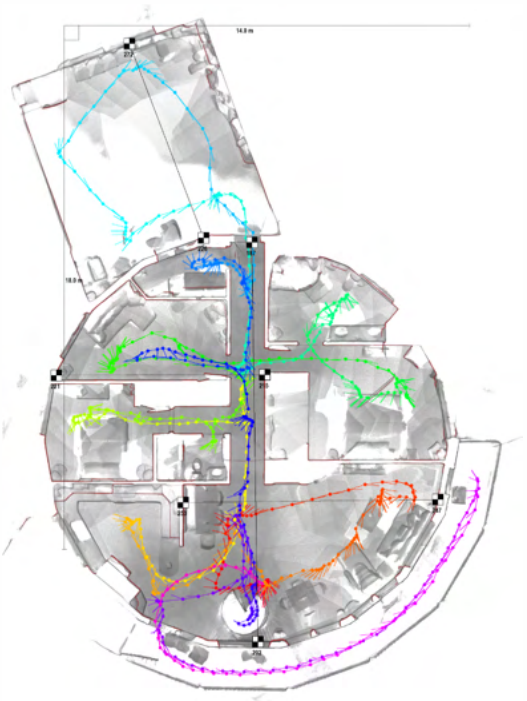
On the **vertical section,** you will see the automatically detected floors, along with offset lines at given heights (complying with local area measuring rules, eg. 150cm for the NEN2580 and 5ft for the ANSI Z765 standard)



For each detected floor you will see a **horizontal section** accompanied by its side views.

This backdrop is automatically placed in our drafting software with proper scaling to eliminate any errors and can be accessed at any time to compare with the result model and floor plan.



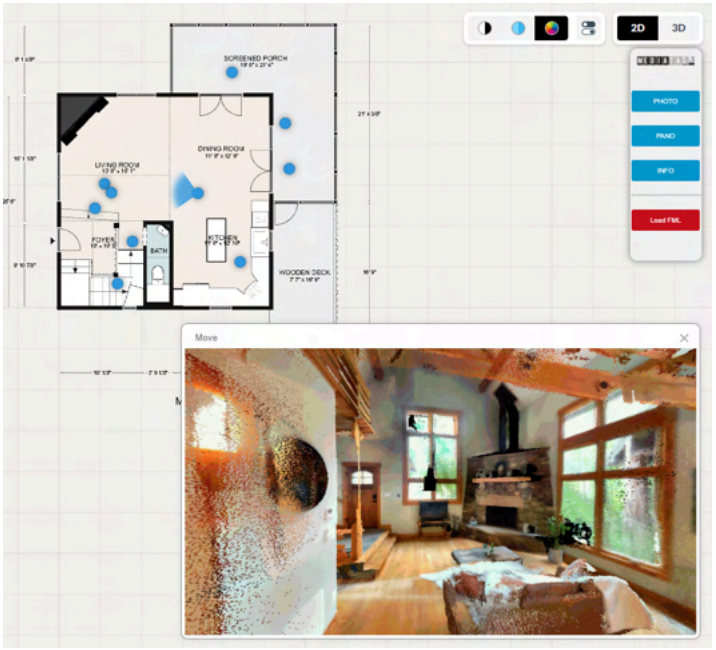


There are also **augmented sections**, containing all additional scan data, such as tags, measurements and scan path, which we usefor troubleshooting and customer training.

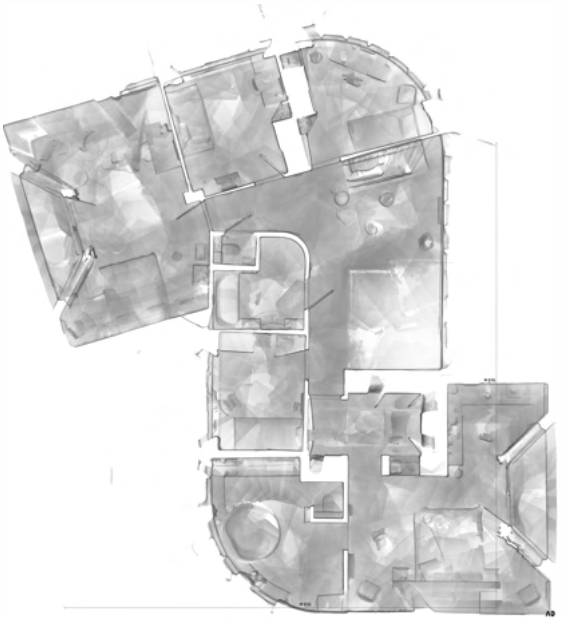
At Mediatask we have built custom scripts that let us leverage the **richness of the 3D data** a Dot3D scan can provide.

All annotations, both in text and photo form, are displayed contextually in our drafting software.

Our scripts also automatically create *panoramic 360 "hotspots"(→)* which our drafters (and clients!) can access to double-check unclear areas in the scan.



With the **proper scanning technique** and a few days of training, even complex scans like the one below can be achieved, in a fraction of the time it would take to measure by hand.



A Dot3D scan made by a client

Floor plan created by Mediatask

Troubleshooting

If you follow the guidelines described above, you should be able to get great results even on your first scan.

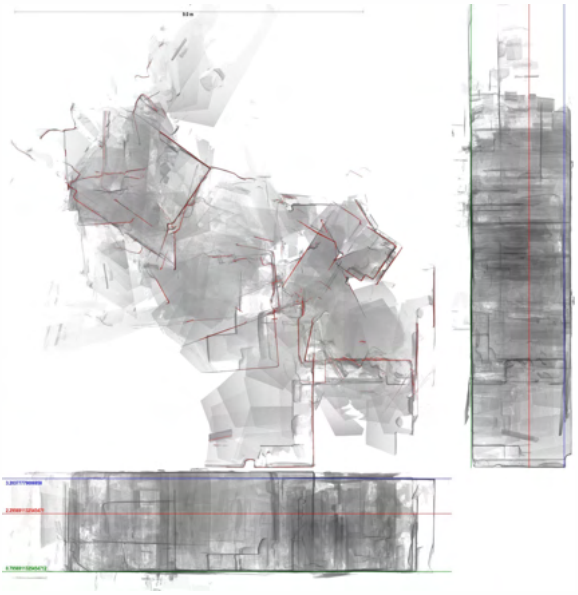
However, some interiors might be harder to capture than others, there might be unexpected situations that will lead to errors in the scan. Check to see if one of these common issues applies to your scenario, if you have further questions or need additional assistance - *please don't hesitate to contact us!*

Ex.1 "My scan is completely out of whack, what went wrong?"

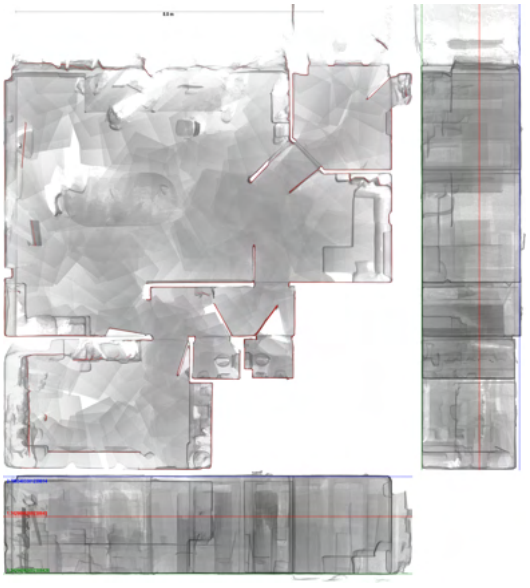
When all parts of the scan look out of place, especially after optimization, it is very possible that you have entered the wrong dimensional constraints or used the wrong units.

SOLUTION: *Open the unoptimized scan, input the dimensions carefully, and run the optimization again. To revert to the scan before optimization go to "File > Load Autosave."*

If you want to preserve the problematic scan you can also open the raw version separately: Choose "File > Open" and navigate to the Dot3D folder on your device. All raw scans are in the "Autosave" folder.



Scan with dimensions entered with the wrong units (meters vs. millimeters)



The same scan, but with units entered correctly this time

Ex. 2 “Parts of the scan are in a completely wrong place”

This can happen if you enter the correct dimension, but assign it to the wrong pair of tags. The app treats the user input with priority so it will try to adjust the scan to fit your entered measurement. With an error like this, the task is impossible so part of the scan is displaced.

SOLUTION: *Re-enter dimensions and optimize again.*

Ex. 3 “Walls seem not to be straight” or “My scan seems a bit ‘wonky’”

Possible causes:

- doors opened/closed during scan - keep doors fixed in place and avoid rescanning them if moved inadvertently
- staying too close to walls - make sure to follow the scanning tips displayed in Dot3D. Keep a distance of 2-3 meters from walls and even more from entirely white/blank walls,
- not making enough loops - without sufficient overlap in the scan the app has too few “anchor points”.

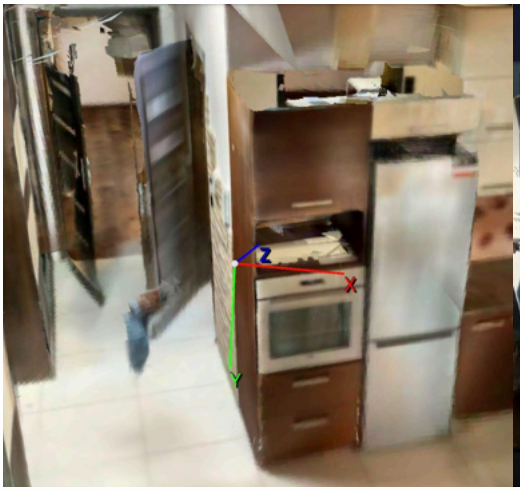
SOLUTION: *Follow the instructions on strategic target placement and make sure you close the full loop, as well as secondary loops when revisiting scanned areas such as hallways or common spaces*

Ex. 4. "The scan is strangely rotated'"

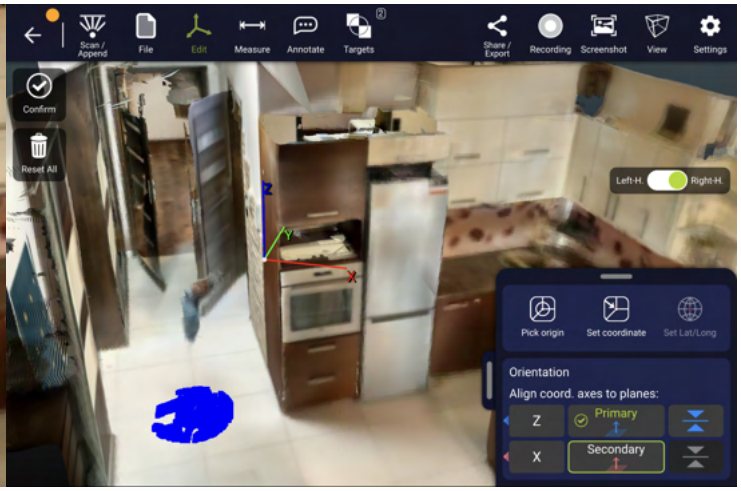
Your device is equipped with a gravity sensor so by default your scan should be properly aligned: **the (blue) "Z" axis should point "up"** by default**.**

Very rarely the coordinate system may be rotated. You can adjust it by choosing **Edit > Coordinates** and pressing the button marked **"Primary".** You can then long press on a horizontal surface, e.g. a floor, and dot3D will automatically adjust the coordinate system.

Press "**Confirm**" and **save** your scan.



Wrong coordinate system (notice Z is not up)



Correcting the Primary "Z" axis so it faces up

NOTE: *You don't have to change the "X" and "Y" axes, we automatically rotate the scan to align with the screen edges when you upload the scan to our portal.*

Didn't find what you were looking for?

We have tried to compile as much useful information as possible in this short guide to let you master mobile 3D scanning. If you feel there is something missing or would like to suggest changes - please get in touch with us at **contact@mediatask.co** !

www.mediatask.co
contact@mediatask.co

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