Open-source public guide

Hi, this guide has been created as part of my undergraduate year research project. It is intended to allow anyone to build their own prosthetic for a very small cost. This was completed over a short period of time and therefore will not be without flaws. If any issues arise, please do not hesitate to contact me. Happy printing :)

Contact: defyinglimbitiations@gmail.com

Materials Advice

Before starting your prosthetic build, it's important to gather the right materials. Below is a guide to the essential components, with tips on sourcing, suitability, and alternatives where applicable.

1. Filament for 3D Printing

- **Recommended**: **PLA (Polylactic Acid)** filament

- **Why PLA?**

    - Easy to print with on most desktop 3D printers

    - Affordable and widely available

    - Biodegradable and derived from renewable sources

    - Produces smooth, rigid parts with good dimensional accuracy

- **Tip**: Avoid leaving PLA in direct sunlight or humid areas, as this can make it brittle.

- **Where to buy**: Online retailers (Amazon), or local maker/hobbyist shops

- **Optional Upgrade**: PETG or Nylon (for more durability and flexibility) – only if your printer supports higher temperatures

2. Magnets

- **Recommended**: **Neodymium disc magnets**, 10x2mm in diameter

- **Use**: To attach interchangeable parts (e.g. claw or hand) securely

- **Advice**:
  - Warning: these magnets are very strong
  - Keep away from children or devices that could be affected by magnetic fields
- **Where to buy**: Online (Amazon, Hobby stores)

3. Elastic and Fishing Line

- **Elastic**: Standard sewing elastic is used to re-open the claw after grip
  - Should be flexible enough to stretch but not overly tight
  - Can be found in craft stores or sewing sections
- **Fishing Line**: Used to pull the claw closed with elbow movement
  - Choose medium-strength monofilament (we used 27lbs)

4. Upper Arm Support

- **Recommended**: **Shin pads**
  - Affordable, ergonomic, and widely available in sports stores
  - Should cover mid-to-upper arm comfortably
  - Attach with Velcro straps or elastic bands for adjustability

5. Adhesives

- **Epoxy Resin**: For attaching components like magnets or segmented printed parts
- Be sure to work in a **well-ventilated area** and avoid skin contact

6. Optional Tools

- **Sandpaper** (for smoothing sharp edges post-print)
- Pliers (recommended for breaking supports
- **Screwdriver** (if any screws are added in future upgrades)

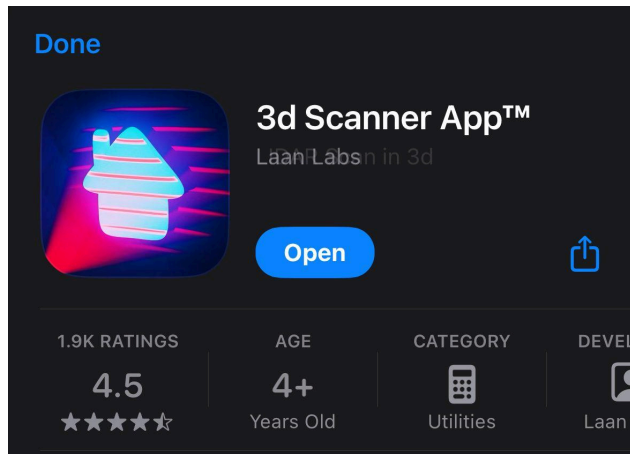- **Hairspray or glue stick** (to help prints stick to the print bed during printing)

Estimated Total Cost

- **PLA filament**: ~£10–£15

- **Magnets**: ~£4–£6

- **Elastic + Fishing Line**: ~£3

- **Shin pads**: ~£5–£10
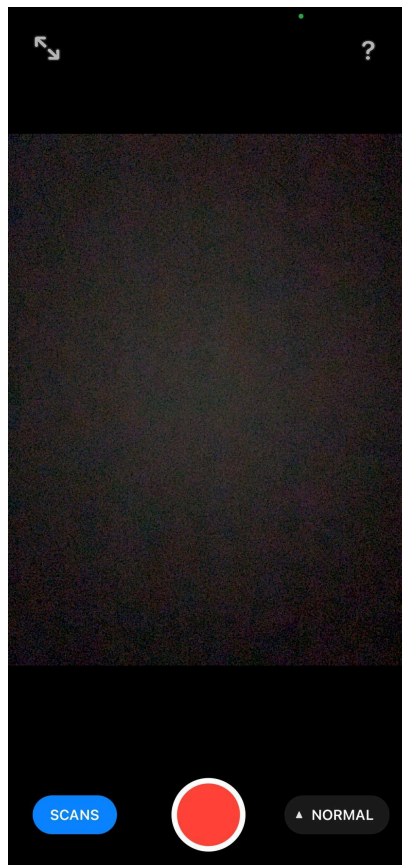
- **Glue/Sandpaper**: ~£5 (if not already available)

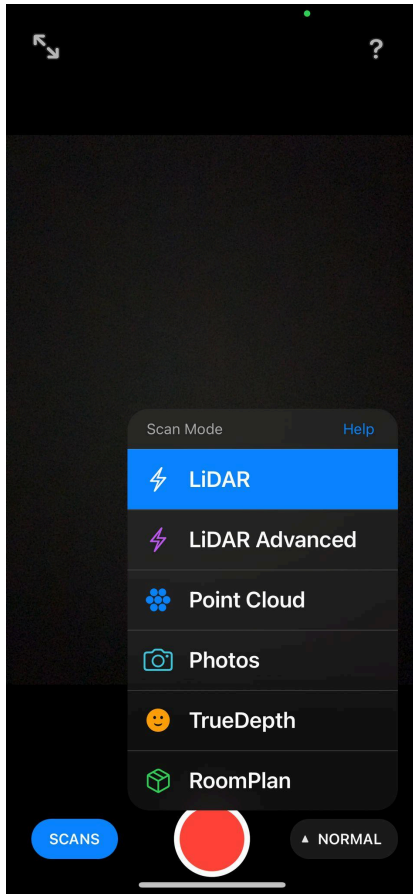**Estimated total cost: ~£25–£35** (assuming access to a 3D printer)

Step-by-step

Download 3d scanner app by Laan Labs

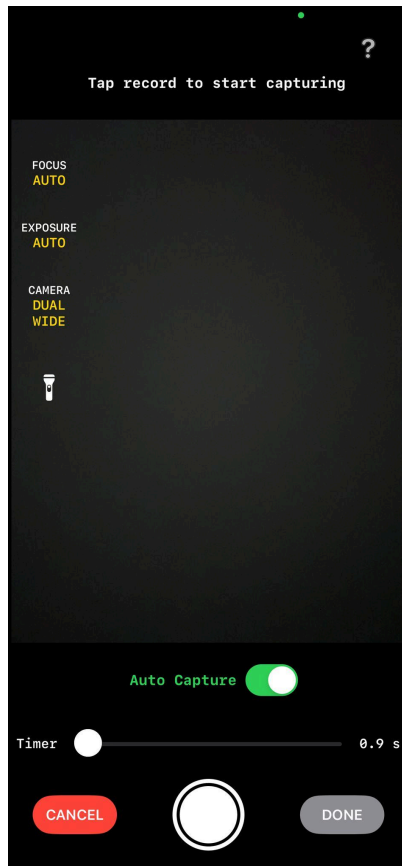Open the app and select the normal option in the bottom right

Select photo

Select the distance to capture>>>>>

Toggle on autocapture

Ensure the camera is in focus on your subject

Mark both arms with at the SAME location on each

insert picture of medial epicondyle

- Where to mark: extend your elbow fully with the inside of your forearm facing upwards, you should feel a bony protuberance on the inside of your arm (this is your medial epicondyle), mark this point with a small horizontal marker line
- Choose whichever side you would like to scan first i.e. stump or full arm.

Measure your arm from the mark to the end of your fingertips, with your hand in the same position it will be during recording, I recommend a relaxed position if you intend to print a functionless prosthetic. This measurement should be around 400-475mm.

Select the red record button to begin automatically taking photos

- get someone else to record as any movement by the subject will result in imperfections in the model
- remember your capture distance, you must stay within this to build the model
- remember to go slowly to get a high quality model
- remember to get angles from all sides of the subject to build a complete 3D image
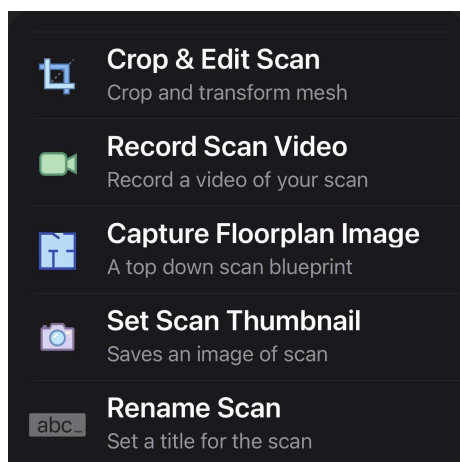- you should have approximately ___ images

Once you have modelled one
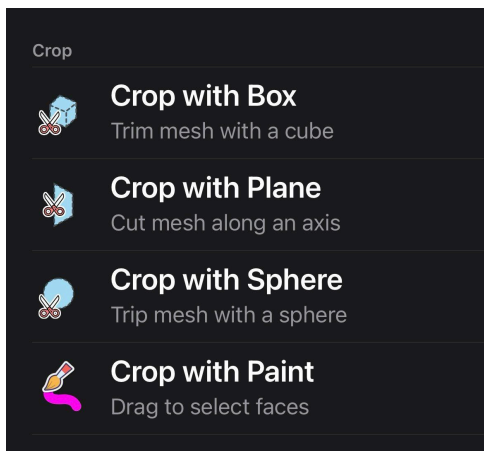
Select "upload & process"
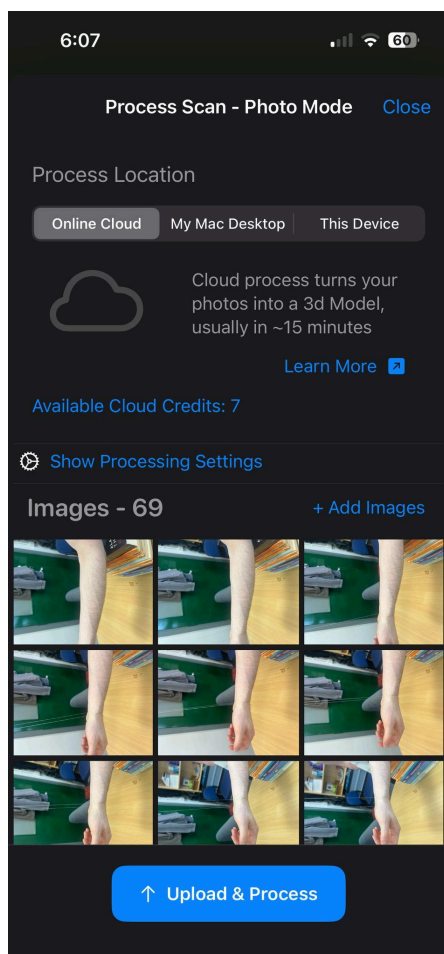
Then click "More".
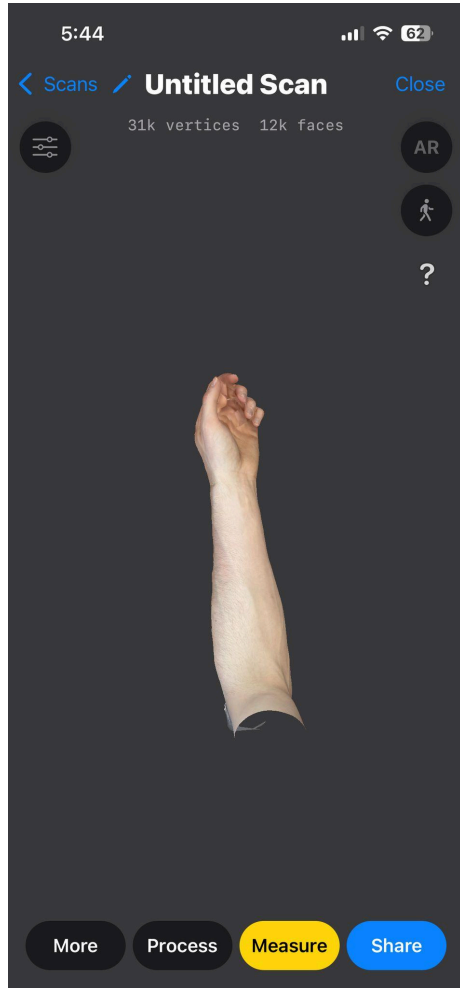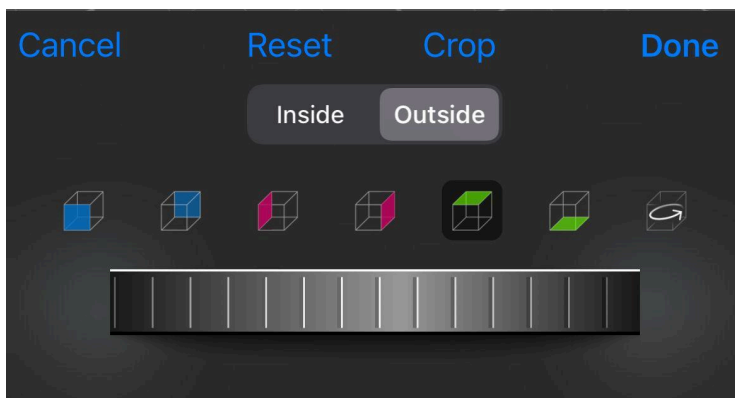

Then "Crop & Edit Scan"

Select "Tools".

Then "Crop with Box" to trim the mesh

Using the scroll bar at the bottom of the screen you can adjust the size of the box

You can select different box faces to control by selecting between them just above the scroll bar.

No details outside of the arm should have been picked up but if they have crop them out.
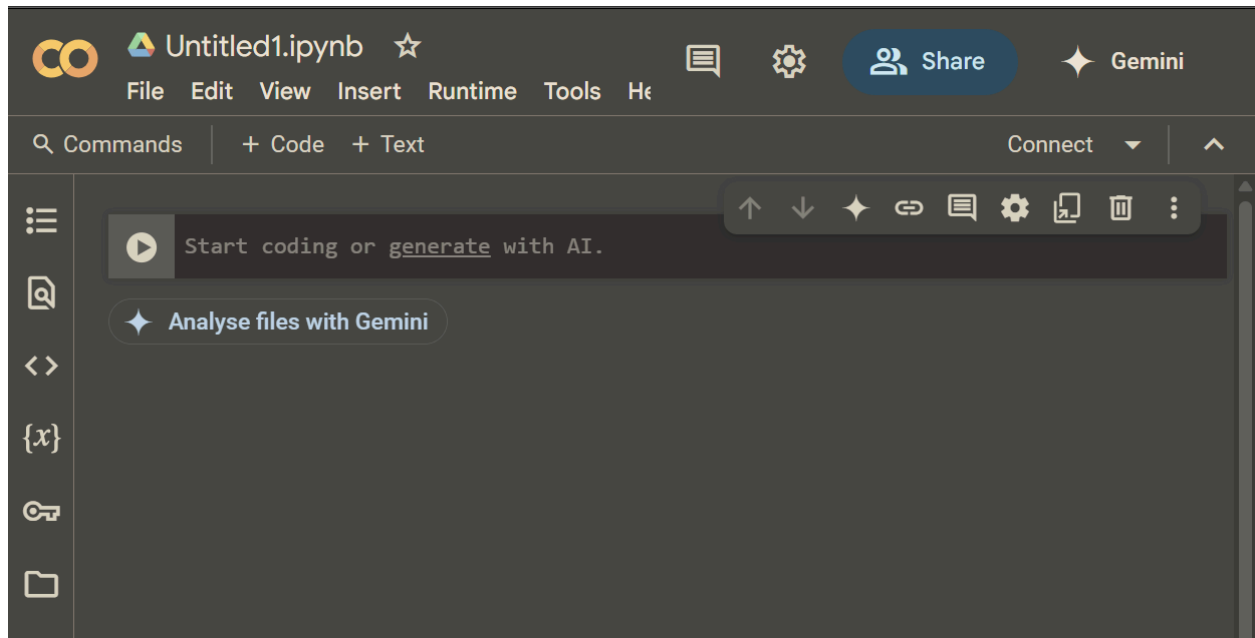
Make sure to line up the face of a box with the mark you have made on your arm, perpendicular to the direction of your arm's length. This ensures both models will be cut to the same size.

Export the file as an STL

Repeat the process for the other limb.

Open google colab and open a new notebook
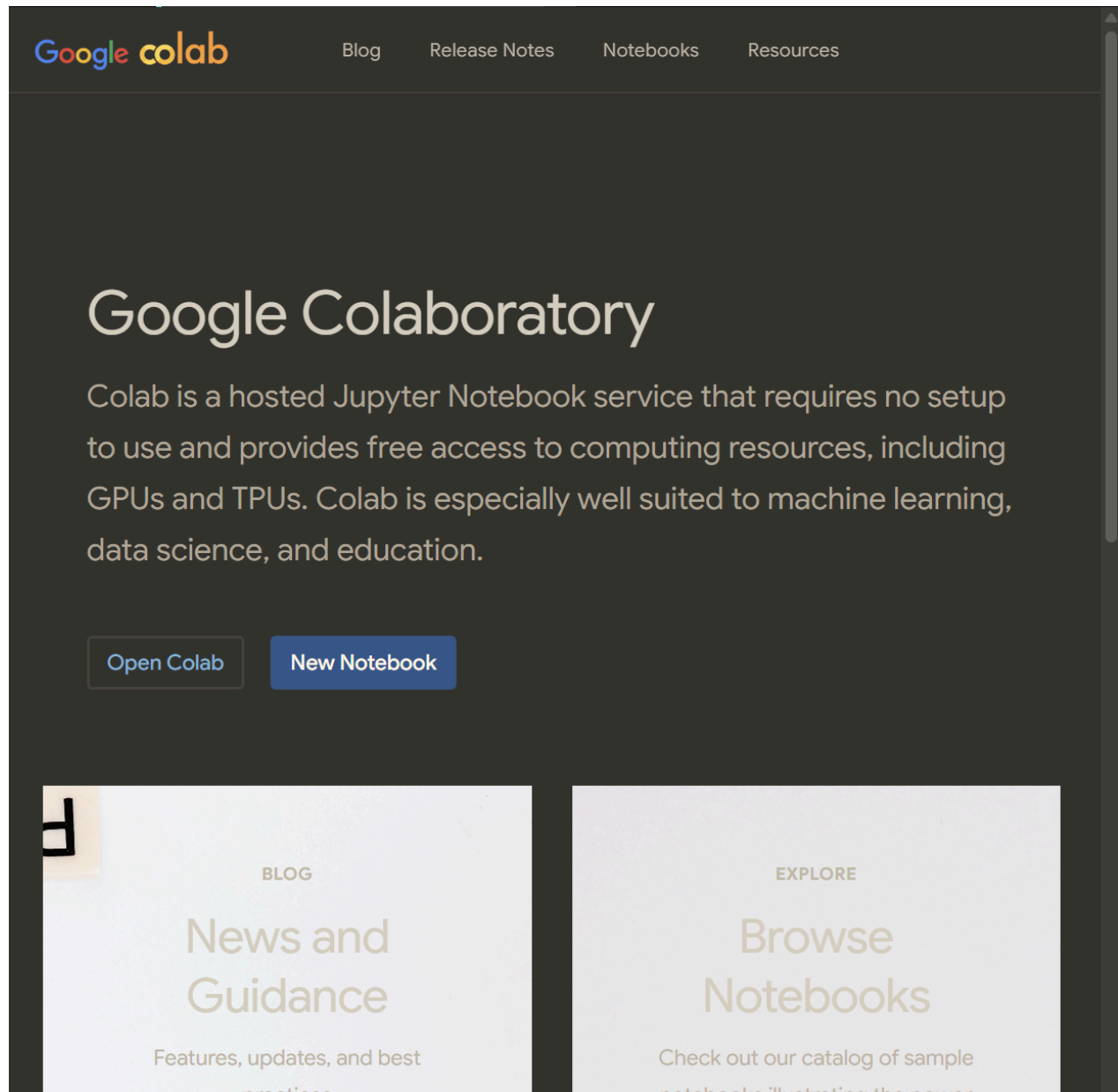
Insert code from github

This will provide you with a model of the socket which you need to print.

Upload this stl file to a printing software associated with your chosen printer and slice it
- Bear in mind the size of the model, it may be too large for your printer, if so you may need to cut the model in two, print the halves separately and then stick them together afterwards. Alternatively try to source access to a larger printer, local libraries sometimes have them.

Build upper arm attachment

PRINT OTHER FILES IE CABLE HOUSING AND ELASTIC WEBBING ATTACHMENT
Please contact defyinglimbitiations@gmail.com for these files

Temperature: for Flashforge Adventurer Pro 3 - 207 degrees for extruder, 55 for plate