Portfolio

MEng Design Engineering (2027)

Omar Ibrahim

👋I'm Omar, a passionate and skilled

Design Engineer

This means I have the skills to not only design and build things that work, but also things that look beautiful. I am currently in the second year of my Design Engineering degree at Imperial College London and greatly look forward to continuing to improve my skills through bigger and better projects with more and more positive impact on the world around me

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DJI Alta Suite and Gimbal

This team project sought to give amputees the ability to partake in and excel in the hobbies they once loved by creating a custom prosthetic that allowed users to change its end attachment to suit their tasks. We found that we could also create an “armed” user version hence Alta Custom (for amputees) and Alta Prime (“armed”) users. The attachment we chose to focus on was a gimbal.

Personal contribution: Physical design Development | App design | Software development | Photography | Videography

Product Assembly

How the product comes together and is taken apart is pivotal for manufacturing costs and repairability. While we did not recommend users disassemble the product, it was still vital that the processes be accessible and follow standard practices.

Step 1

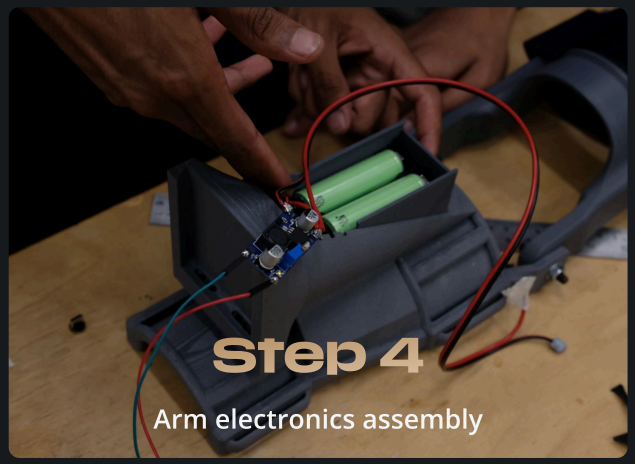
Manufacture components

Step 2

Assemble gimbal electronics

Step 3

Complete full gimbal assembly



Step 4

Arm electronics assembly

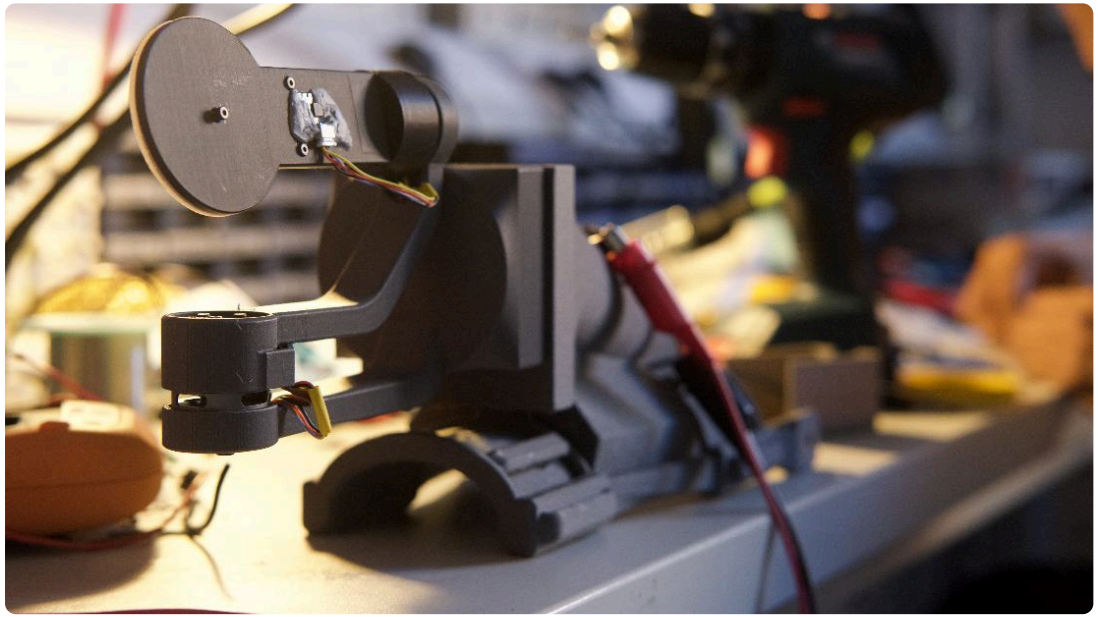
Step 5

Connect remaining components

Step 6

Join the arm and the preferred attachment

Note that Steps 2 and 3 can be substituted with step 4 and 5

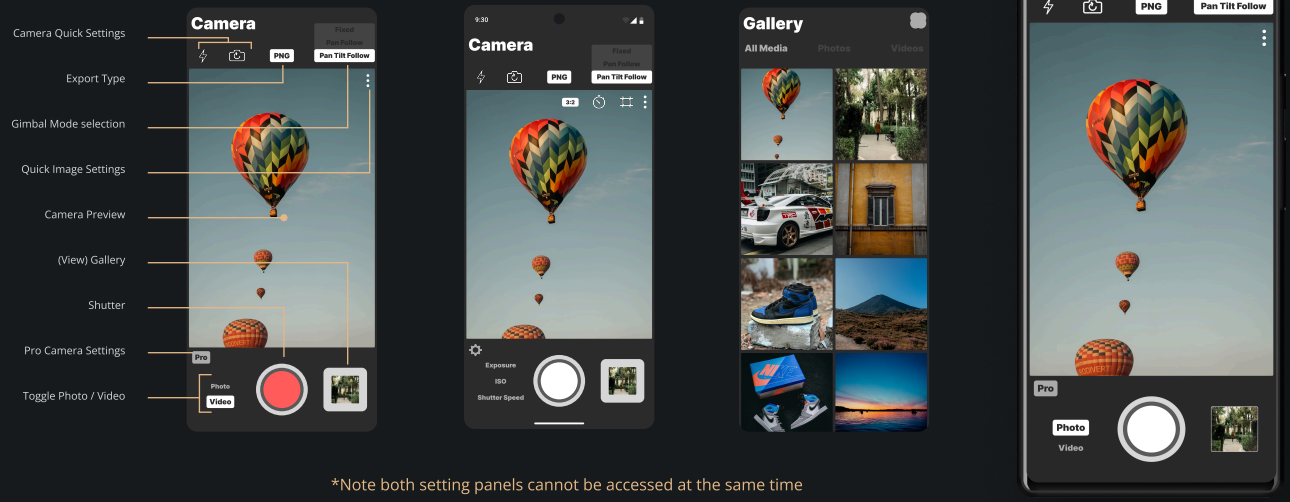


Physical Components

Overall components were very simple. The “brace” that the users would physically wear consisted of a triceps support piece and a main body where the attachment would mount to via magnetic pogo pins.

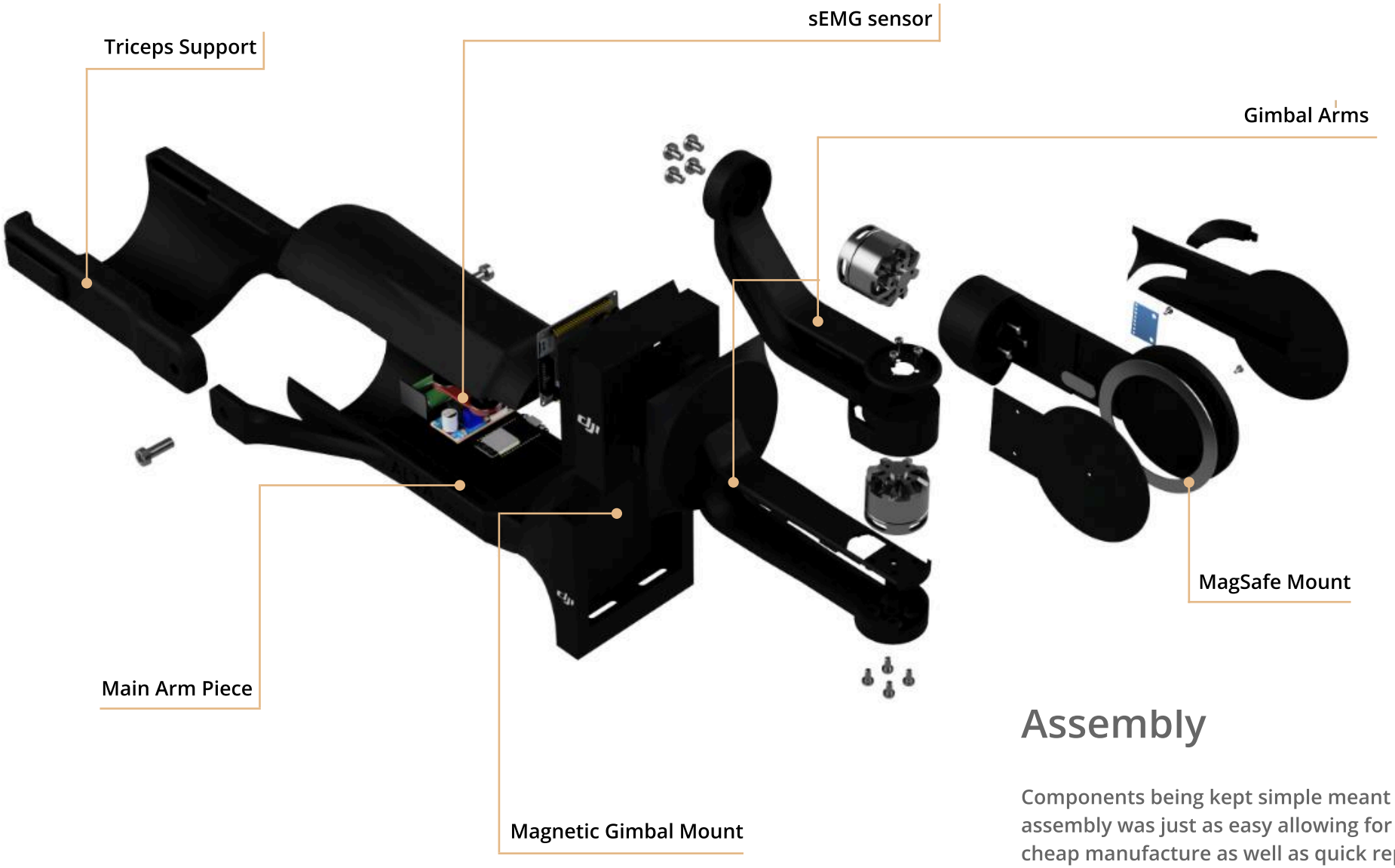
Companion App

This was designed to pair via Bluetooth to the arm and the gimbal allowing users to control gimbal functions and take pictures using muscle signals in their residual limb / forearm



*Note both setting panels cannot be accessed at the same time

The Components



Assembly

Components being kept simple meant that assembly was just as easy allowing for easy and cheap manufacture as well as quick repairs.

Note that the ***Top Left*** is the ***new*** design ***(2)*** created for optimal CFD values while the ***bottom right*** is the ***original*** design ***(1)***

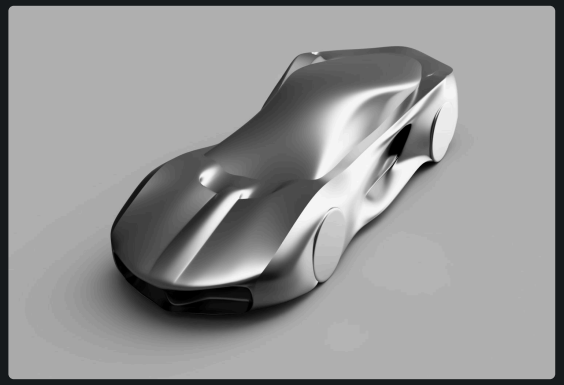
Ferrari Trevento

The brief here was to design a car ot be as aerodynamic as possible using principles of Fluid dynamics to guide the design process. When faced with the choice of car type, the obvious choice is a Supercar and so this project takes the aerodynamic features of 3 of the world's fastest cars and wraps it in a Ferrari package. And does that not once, but twice.

Personal contribution: Physical design Development | Market Research | Computational Fluid Dynamics Analysis

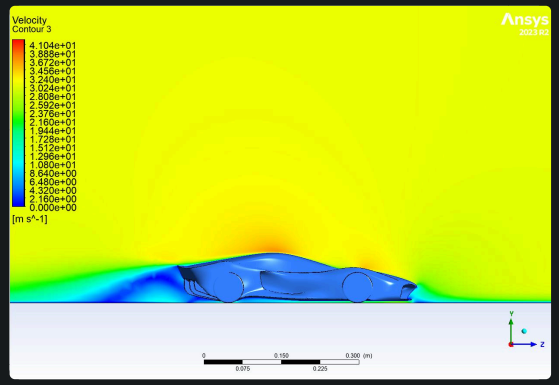
The Process

The project had 3 main stages each with immense learnings particularly in the CFD analysis as well as the unique opportunity to take the best set of designs to the wind tunnel for validation of results. The CFD results for both versions are at the bottom.



Initial Design and CAD

Ideation that married the *aerodynamics of the fastest cars* with the *design language of Ferrari*



CFD Analysis

Computation Fluid Dynamics (CFD) analysis aimed at *testing the design against real world parameters*

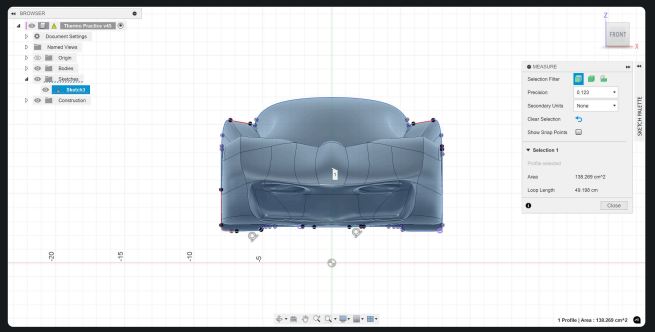
Wind tunnel validation

Taking the designed model into the wind tunnel to provide *validation data* for the CFD analysis

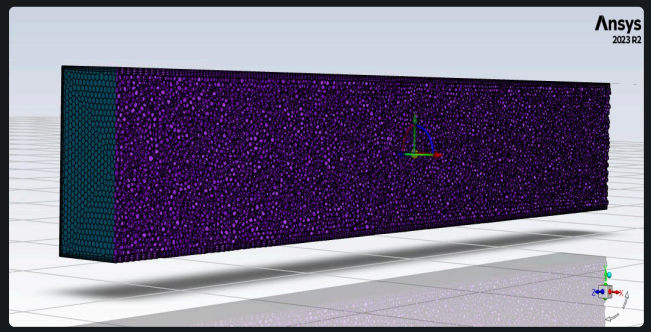
C_{D1} = 0.26412362 C_{L1} = -1.450699 C_{D2} = 0.35886734 C_{L2} = -1.367276732

CFD Analysis

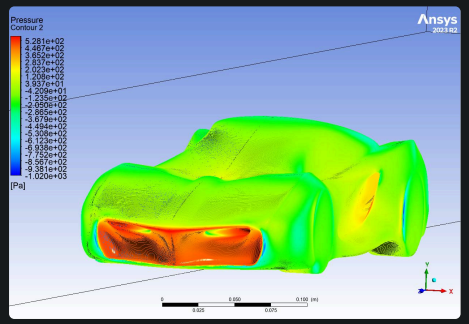
The newest skill gained by this project was the ability to use Anys, an industry standard software, to complete a CFD. This involved a series of intricate steps that, when combined, produce values for drag (C_D) and lift (C_L) coefficient as well as various plots to understand how the design will interact with the world around it. These steps are:



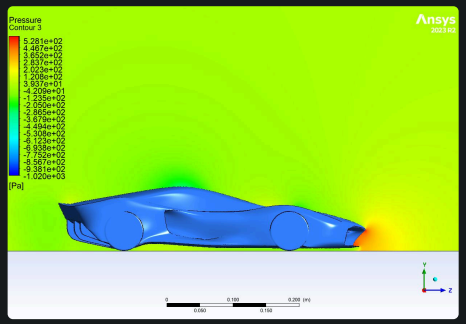
Measurement of Frontal Area



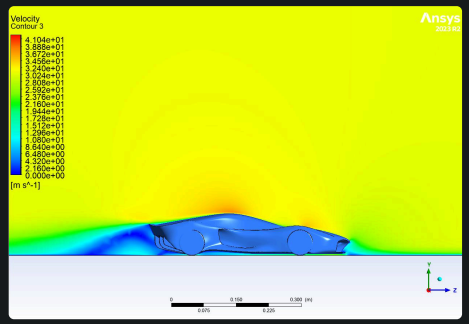
Generation of Volume Mesh



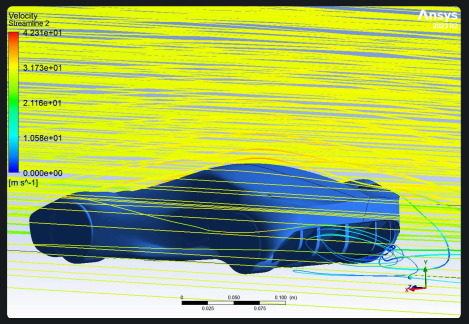
3D Pressure Distribution



2D Pressure Plot



2D Velocity Plot



3D Flow Trajectories

Generation of Results and Plots

TMJ Condyle Implant

The brief here was to design and perform a Finite Element Analysis (FEA) on a temporomandibular joint implant and compare this updated design to a standard. Invaluable insight into the world of implants and biological devices was gained, as well as a strong skillset in ANSYS FEA. The final design is stronger, lighter, and performs better than the provided across all sectors

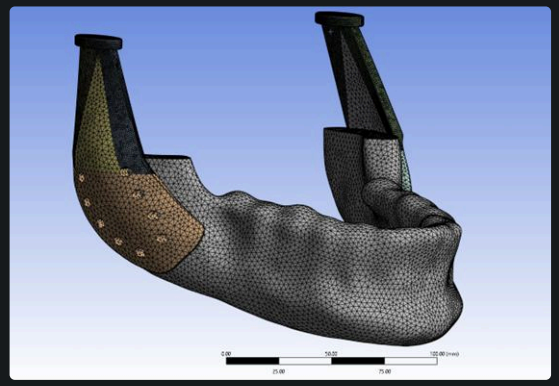
Skills & Software:	Physical design Development | Implant design | FEA ANSYS | CAD & Modelling | Rendering in Keyshot

Finite Element Analysis

The main aim of this module was to learn to conduct **Finite Element Analysis (FEA)** to test and validate the performance of designs under expected loads. This process saw 3 key steps with the final design being the product of revisions made as a result of the results derived.

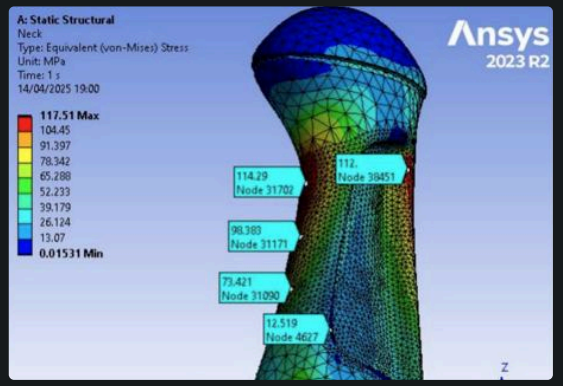
Initial Designs and CAD

Creating and preparing the CAD models that will be used to conduct the Finite Element Analysis (FEA)



Mesh Refinement

FEA setup balancing computation load and accuracy for optimal results



FEA Analysis

Conducting FEA on different model geometries and different model materials for best configuration

Updated Implant Design

The final version of the implant I designed which is lighter, stronger, and more resilient than the provided model. This design also features hybrid joining systems including *both* traditional screws and a dedicated area for osteointegration giving the implant more strength and longevity.

Incoming...

The projects I am currently working on and are nearing completion

MIMIQ

The task was to upcycle a fun, interactive robot that did something interesting. Together with a partner, we created a robot arm that would mimic and mirror the movements of your limbs and would also respond with pre-programmed gestures when touched. The project taught us a lot and I am currently working to revise the physical design and give its movements more character.

Personal Contribution:	Physical Design | CAD & Modelling | 3D Printing | Arduino | Python | Computer Vision | Videography

Website(s)

This is a personal project that has seen many evolutions and much growth over the years. First intended as a blog meant to be a pathway to voice my ideas and thoughts to the world while learning the skill of web development, this project is now solely intended a a portfolio to showcase *all* of my skills and passions, photography and videography included.

Skills & Software: Figma | UI | UX | Visual Studio Code | HTML | CSS | JavaScript | Next JS | Tailwind CSS | GSAP