Leon Zhang

Portfolio

A **design engineer** studying **MEng Design Engineering** at **Imperial College London**.
I am captivated by **novelty** and **design**, and love to bring sought after concepts to real life with his **versatile engineering skillset**.

Contact Me

leon@zhang.co.uk
07480 478278
Leon Zhang
www.leonzhang.co.uk
@lcfz_design

About Me

Leon Zhang

linkedin.com/in/leonczhang
www.leonzhang.co.uk
leon@zhang.co.uk
+44 7480478278

Passionate engineer with a versatile skillset, captivated by novelty in design and in designing concepts which bridge the gaps between design, technology and engineering.

EDUCATION

Imperial College London — London, UK
MEng Design Engineering — Oct 2021 - June 2025
Averaging **First-Class Honours**

Wilson's Grammar School — London, UK
Secondary School — Sept 2014 - May 2021
A Levels: Mathematics (A*), Physics (A), Economics (A); **GCSEs:** 10 A*s, 2 As

EXPERIENCE

HumanForest — London, UK
eBike Design Engineering Intern — Aug 2023 - Sept 2023

- Developed concepts on **CAD** (Fusion 360) to improve the **current design**
- Consulted with several user groups for desired changes
- Accomplished **2 years** of development in **just 2 weeks** and **presented clearly on Figma**, allowing for significantly reduced maintenance costs and increased user group accessibility

PROJECTS

TheraFlex — Imperial College London, UK
Industrial Design Engineering Group Project — Mar 2023 - June 2023

- Designed and engineered a physically-built portable cable exercise machine with an in-built screen
- Coded on **Arduino** for functions and mechanics; Coded with **Python** for **machine learning** body motion **recognition**
- Designed on **CAD** with considerations for **manufacturing, assembly** and **tolerance**

GIZMO: Physical Computing — Imperial College London, UK
Arduino Design Project — Oct 2022 - Dec 2022

- Coded a spin-off Pinball game using an **Arduino**, for functions controlled by **voice** and **head movement** by using accelerometers and sound modules
- Designed mechanisms using **3D-printed CAD** models and motors

TACET — Imperial College London, UK
Human-Centred Design Project — May 2022 - June 2022

- Designed and engineered a physical product to manage stress among university students
- Iteratively designed models using **CAD** (Fusion 360), backed by primary and secondary research methodology
- Implemented a tracker using **Python** and an accelerometer to monitor user' movements, collecting quantitative data to surface UX insights on student patterns

VOLUNTEERING & LEADERSHIP

Imperial ABACUS President — Imperial College London, UK
Association of British and Chinese University Students — Oct 2022 - Dec 2022

- Planned inter-university events with other top London universities' ABACUS presidents, including leading an event with **1500 attendees**
- Predicted cash flow and budgeted expenditures using estimates and expense sheets, taking stewardship of the society's annual **£50,000** turnover and membership base of **450 students**
- Increased memberships via collaborations with 7 Asian businesses in London

Relevant Imperial Modules

Design:
Industrial, Human-Centred, Sustainable

Core:
Electronics, Solid Mechanics, FEA, Materials & Manufacturing, Computing, Data Science

RELEVANT SKILLS

Computing:
Python, Javascript, HTML/CSS, C++, MATLAB

Design:
Figma, Autodesk Fusion 360, InDesign, DFM, Sketching, SolidWorks

Core:
Mechanics, Electronics, FEA, Granta EduPack

EXTRACURRICULAR

Research

"How Should the Future of Motor Vehicles be Made to Be More Sustainable" - 5000 word essay

- Explored the diversity of impacts in an engineering career
- Learned the significance of sustainability's role in automotive industry and in many branches of engineering

Roles

Treasurer - Design Engineering Society at Imperial

- Managing the society's budget
- Dealing with large companies for sponsorships

Skills

Languages

- Intermediate in Mandarin and German.

Music

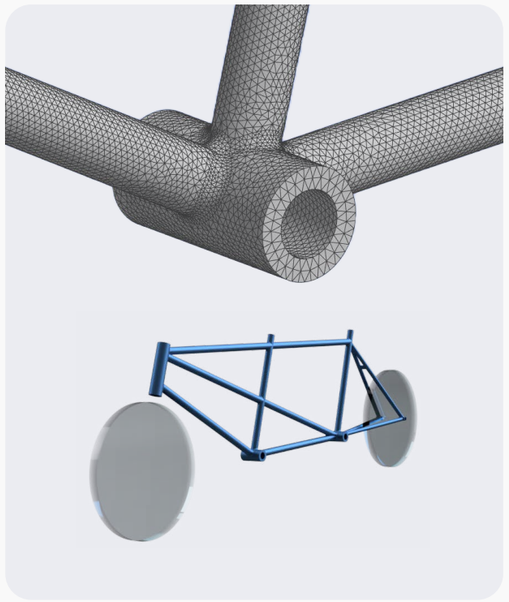
Experienced musician:

- Piano (ABRSM Grade 8), Violin (Grade 4), Flute (Grade 2), Guitar (self-taught) and Music Production (FL Studios)

Hobbies

- Football
- Skating
- Music

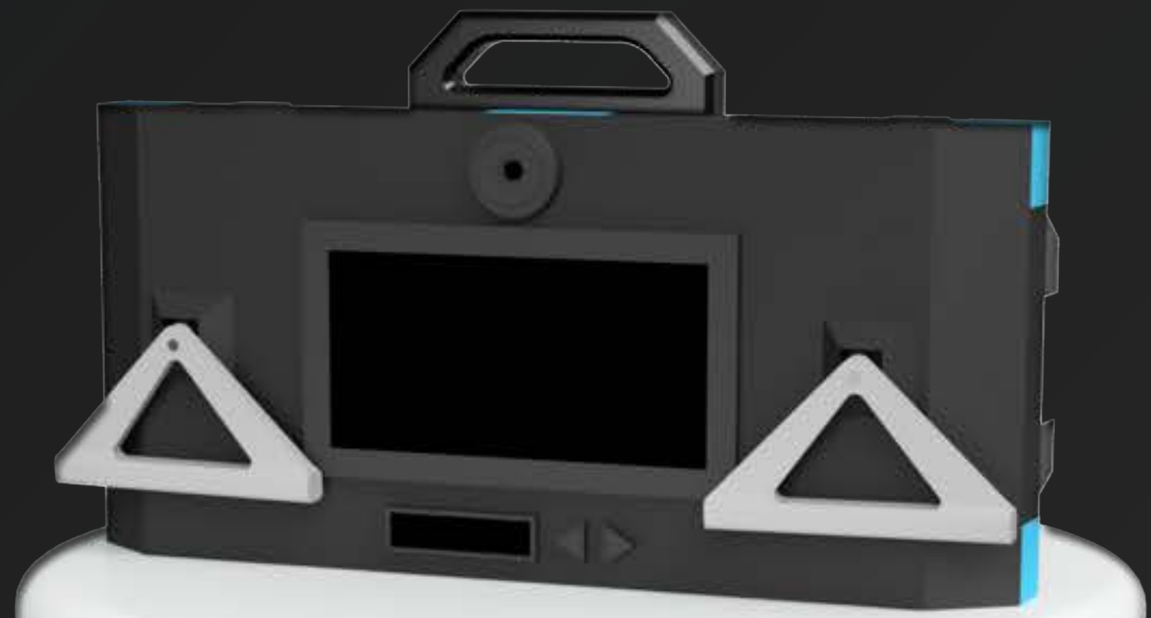
Contents



Therabody TheraFlex Pro

Smart and **Portable** Physiotherapy Device

User Research · DFMA · Ideation · Prototyping · CAD · Rendering · Electronics · Machine Learning
3D Printing



Opportunity: Providing flexibility and convenience in a residential setting for users recovering from musculoskeletal injuries in the shoulder and arm.

Solution: An accessible and portable exercise machine with highly interactive catered features for guidance.

Therabody were not engaged in any consultancy or collaborative capacity with this project and the outcome is in no way endorsed by them. Any publicity is limited to personal and academic use.

The User

As one of the more **prevalent injuries**, the chosen user group were those with **musculoskeletal shoulder injuries**. The main goal was to develop a product that **provides accessibility**, so they can recovery in the **convenience of their homes**.

Musculoskeletal shoulder injuries are a **PAIN** to recover from.

Doctors have tried to help...

But recovery is commonly limited:

Low Self-Esteem

Accessibility

Time Constraints

Lack of Motivation

Finance

Existing Challenges

Out of the existing recovery products, **users still face challenges** which involve **accessibility**, **affordability**, and **usability**. There needs to be a greater level of **interactivity** and **informative guidance** in these products.

Multiple products attempt to provide or assist recovery...

But they **fail** in:

Interactivity

Guidance

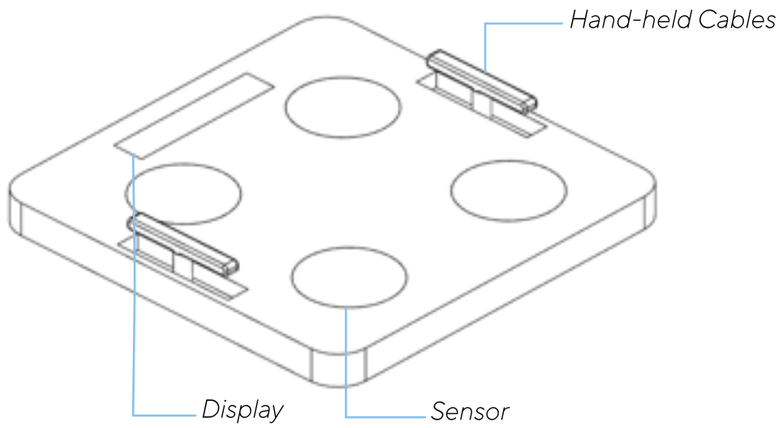
and

Affordability

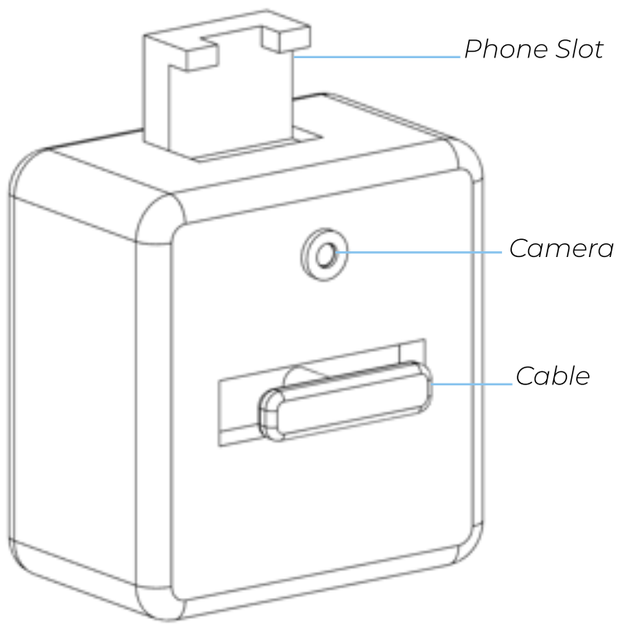
Initial Ideation

Exercising was researched to be the most effective and active course of recovery, amongst others like massaging and cold therapy. Designs were iterated to provide the user a highly convenient and interactive exercise machine.

IDEA: *Exercise Weight Board?*

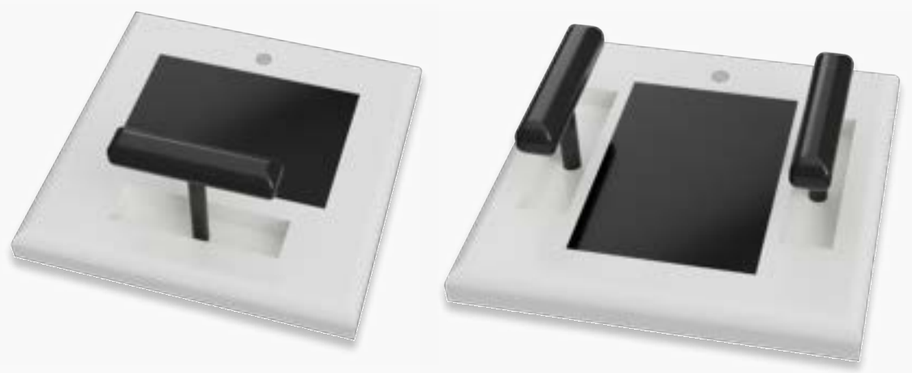


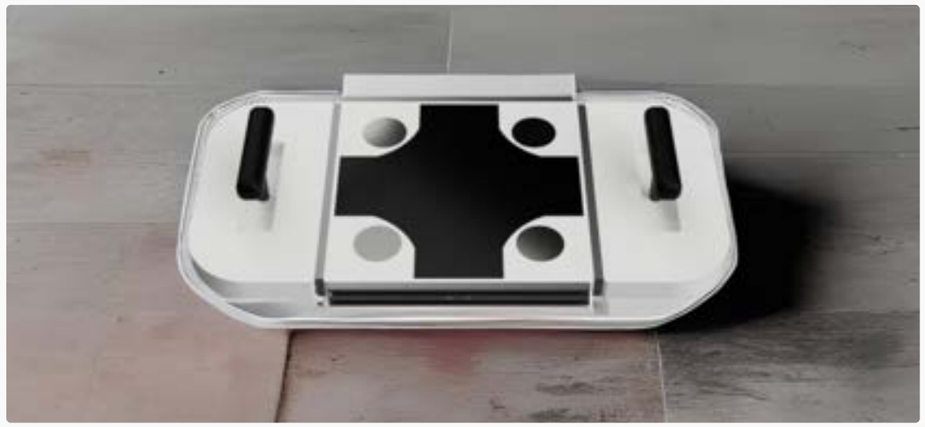
IDEA: *Portable Physiotherapy?*



Ideation Development

With an overall design idea in mind, I continued to iterate through different styles of interaction and display to find the most intuitive one using feedback from users.





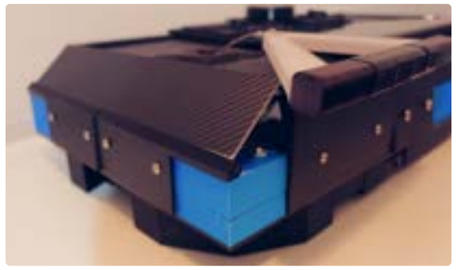
Prototyping 1

Exercising was researched to be the **most effective** and **active course of recovery**, amongst others like massaging and cold therapy. Designs were iterated to provide the user a **highly convenient and interactive** exercise machine.

Casing Design

The design followed Therabody's branding and products. With their common theme of convenient and portable recovery methods, this carriable case and body provided the same experience.

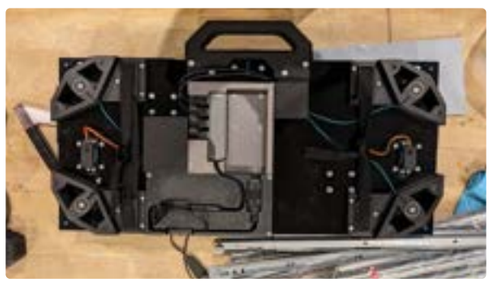
User Interface · Market Research

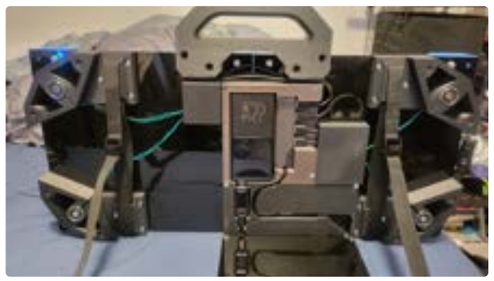


Wall Attachment

Testing the feasibility of electromagnets for wall attachment.

Ideation · Prototyping · Component Sourcing
Power & Load Calculations





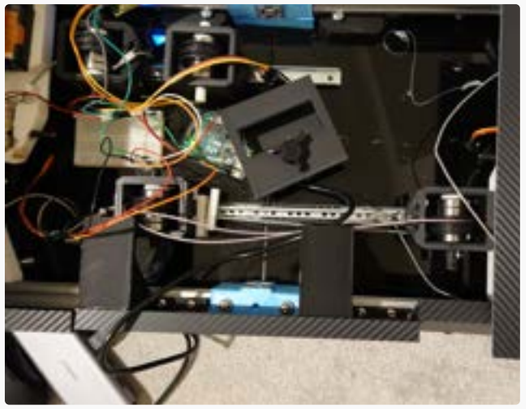
Prototyping 2

This section of prototyping heavily involved **calculations**, **iterative testing**, **electronics**, and **Arduino coding**.
The ultimate goal was to provide **variable cable resistances** to the user in increments. The mechanism was required to **retract the cable** after each rep.

Resistance Mechanism

Iterating through different mechanisms before settling on block and tackle pulleys.
This system was 3D printed to test for discrete resistances using a breadboard with an Arduino Uno

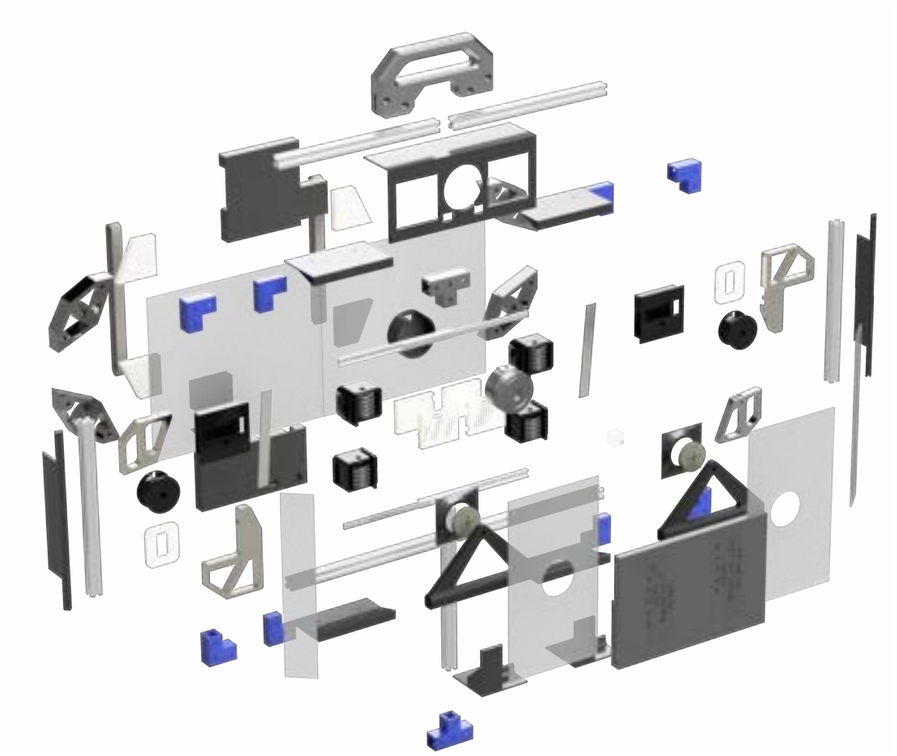
Ideation · Prototyping · Power & Load Calculations
Arduino · Electronics

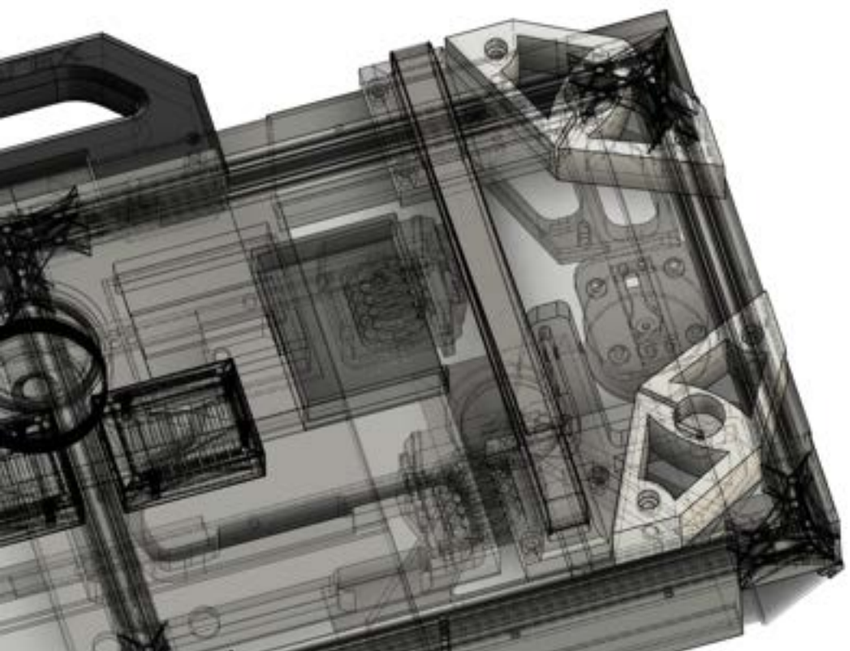


Exploded View

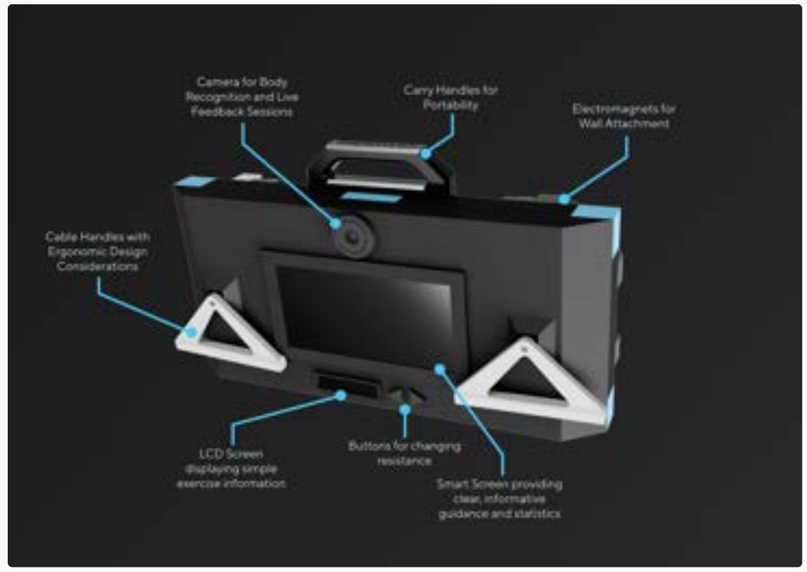
The final physical design was modelled on Fusion 360 before building to make the assembly process easier and more accurate to the sought after design.

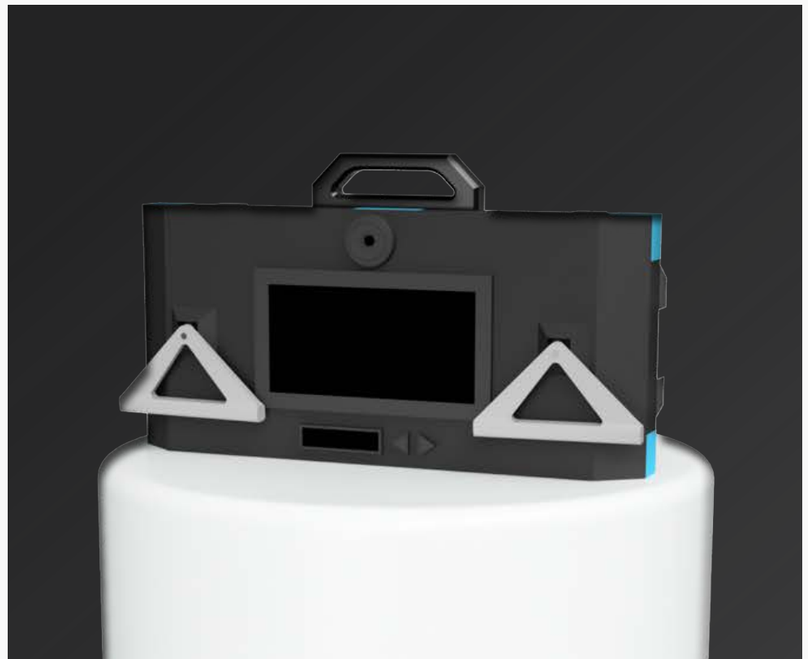
CAD · DFMA · Design for Assembly





Final Design





FireBall

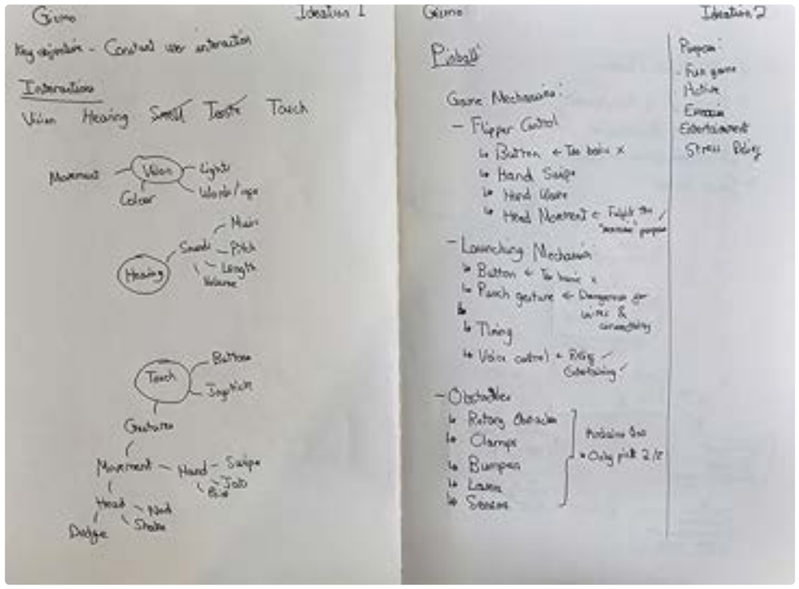
Pinball game involving mechanical obstacles, controlled by head movement and voice volume.

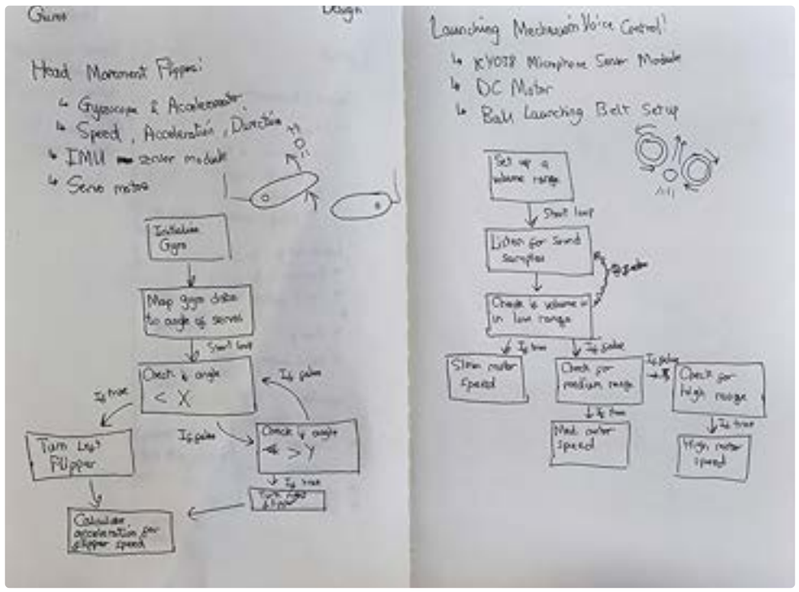
CAD · Fusion 360 · Electronics · Hardware
Arduino · Coding (C++)

Ideation

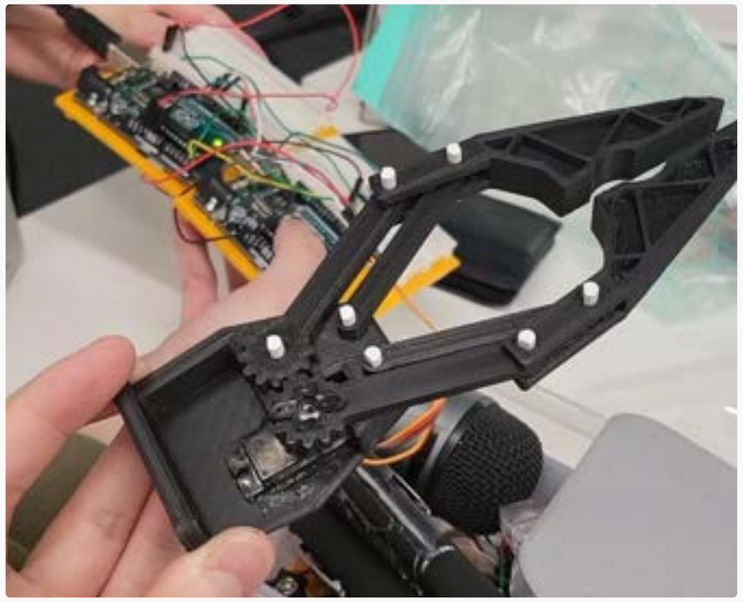
This ideation phase began on the sketchbook, which shows the process through which the FireBall device was designed.

Ideation · Storyboarding · Flow Diagrams





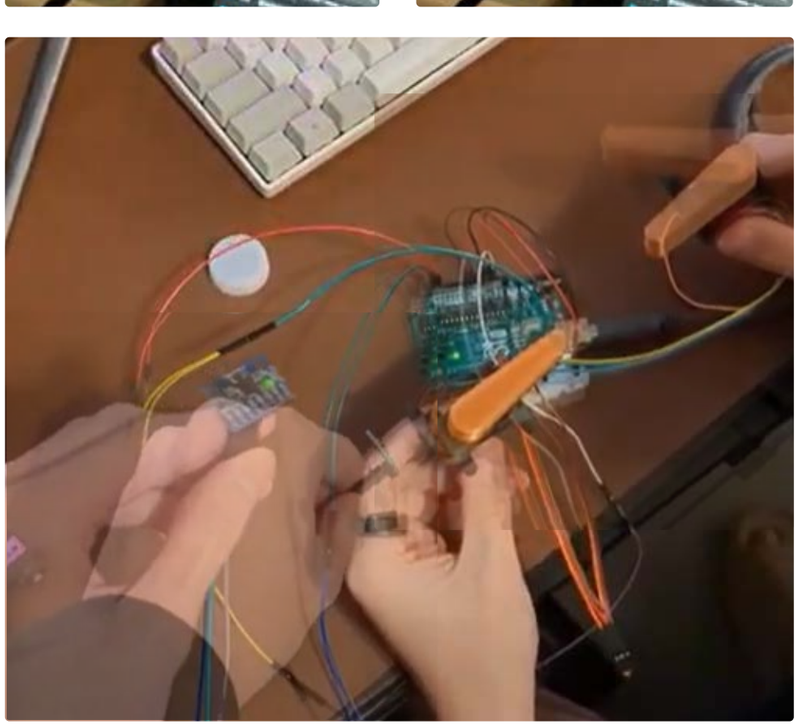
Physical Prototyping



Game Mechanics

Powered by an Arduino, these mechanisms were designed for the game's functionality, including obstacles, flippers, and sensors.

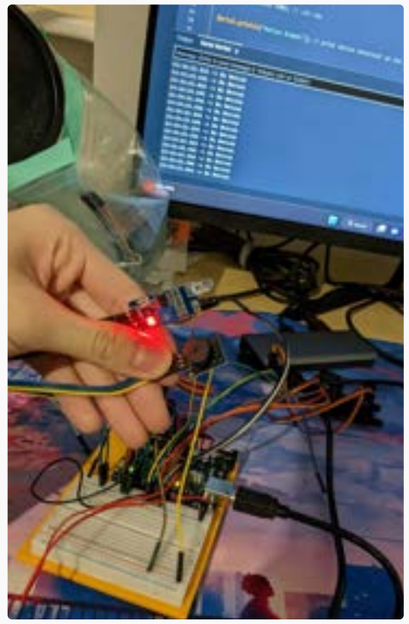
CAD · DFMA · Design for Assembly

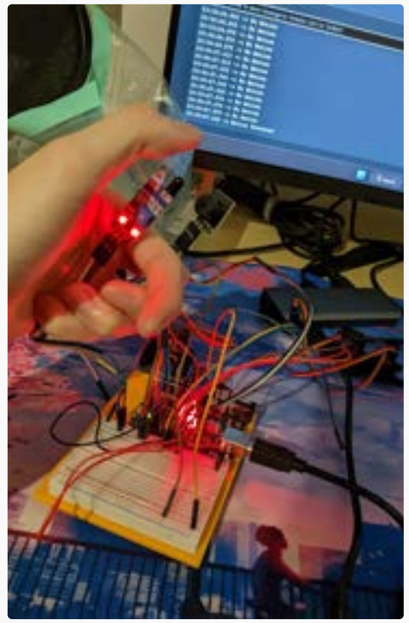


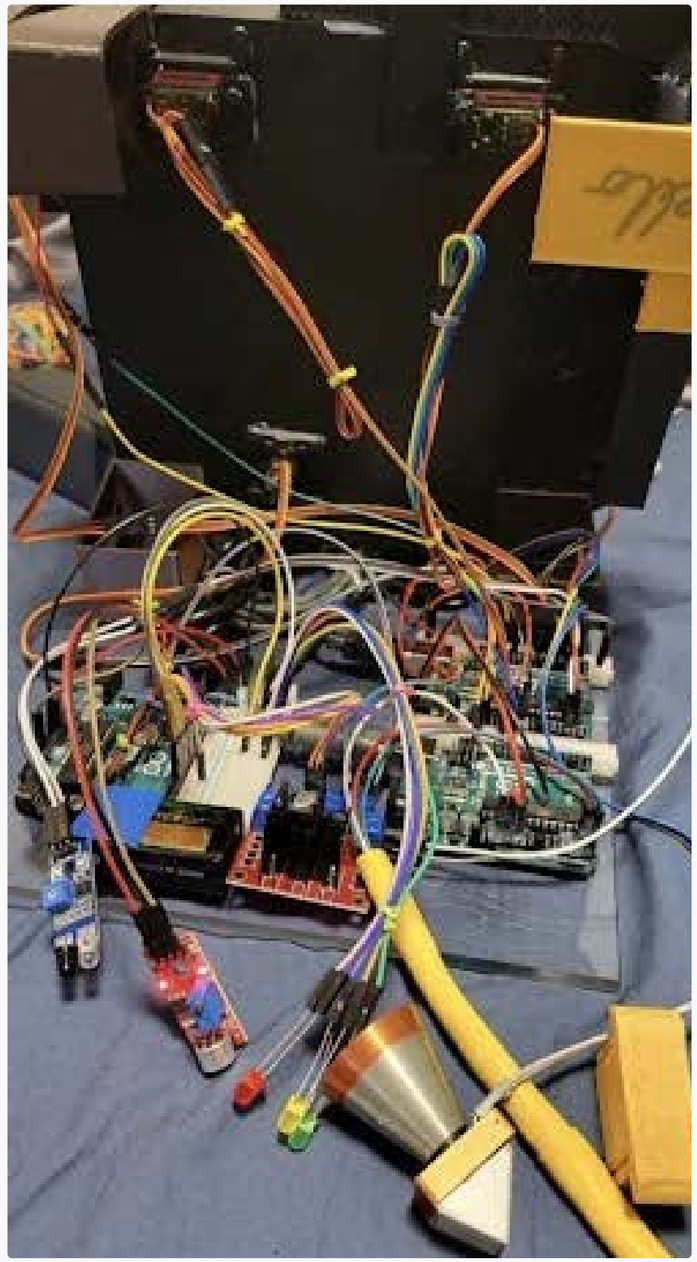
Hardware

To clean up the wiring, the electronics were placed underneath the casing of the pinball game.

CAD · DFMA · Design for Assembly







FireBall In Play

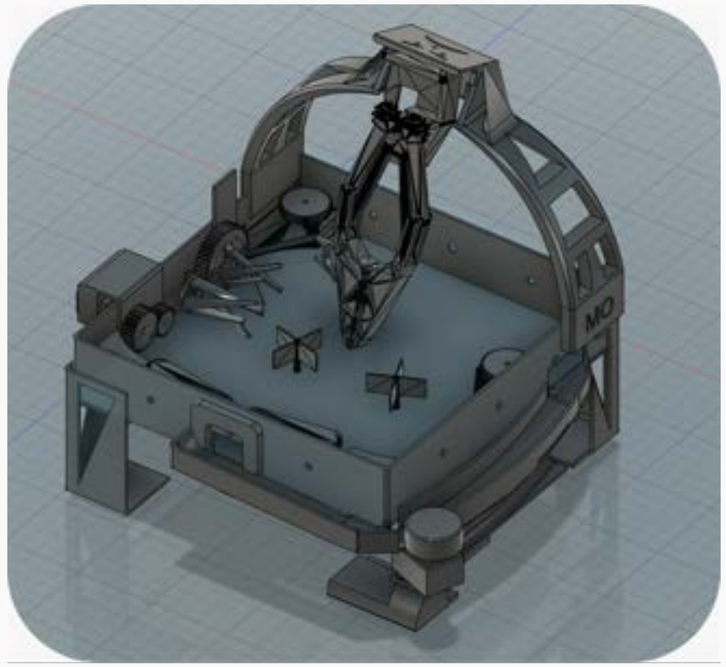
Powered by an Arduino, these mechanisms were designed for the game's functionality, including obstacles, flippers, and sensors.

CAD · DFMA · Design for Assembly

GAME INSTRUCTIONS:

- Control the flippers with your head tilt
- Start the game by using the microphone
- Louder voice = Faster launch
- Keep the ball in the board

Final Game



Silencing Stress

Brief: Design a product that encourages university students to take breaks, in order to increase productivity and diminish procrastination.

Solution: The TACET device consists of a smart timer which notifies the user whenever they should take a break from work. This pairs with an app for a catered user experience.

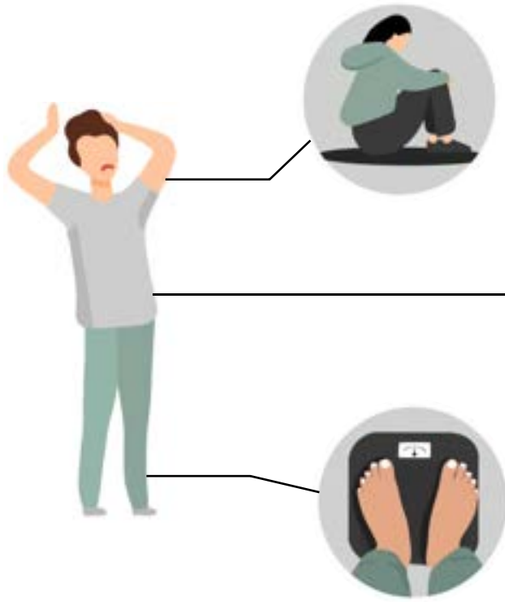
3

The User

User analysis showed that stress predominantly comes from intense workload combined with poor time management.
The goal of this product was improve our user's organisation and time management so that their workload is reduced, and they can spend more time on their de-stress activities.

Market Research · User Research

60% of college students feel so stressed they can't get their work done on more than one occassion.



This leads to:

Depression
Anxiety

High Blood Pressure

Obesity
Eating Disorders

The root cause is:

Procrastination

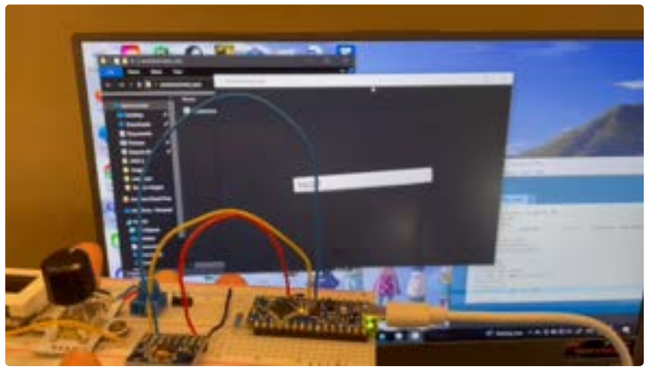
Ideation

After converging on the concept of a stress tag, different designs and shapes were ideated to develop the ideal portable stress tag, which the user can take with them everywhere they go.

Ideation · Sketching · User Feedback

Prototyping

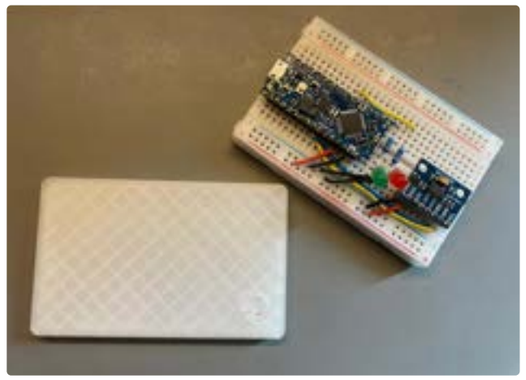
By testing closely with users, prototypes were designed and altered for their functions depending on common habits and feedback from usage.

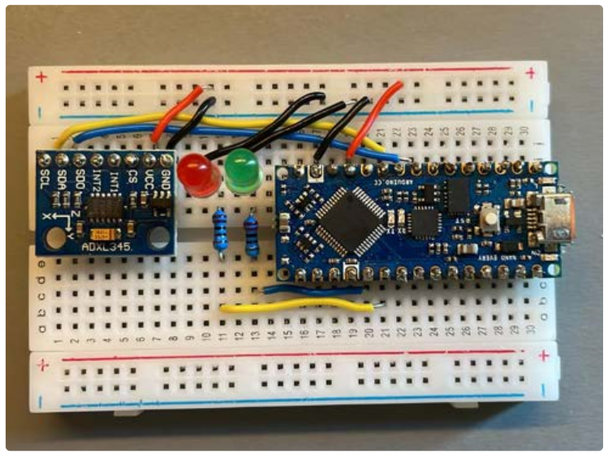


Electronics

To detect whether a user is actually undergoing the said “break” activity, an accelerometer detects the user’s movement while the product is on them.

Ideation · Prototyping · Arduino
Electronics · User Feedback

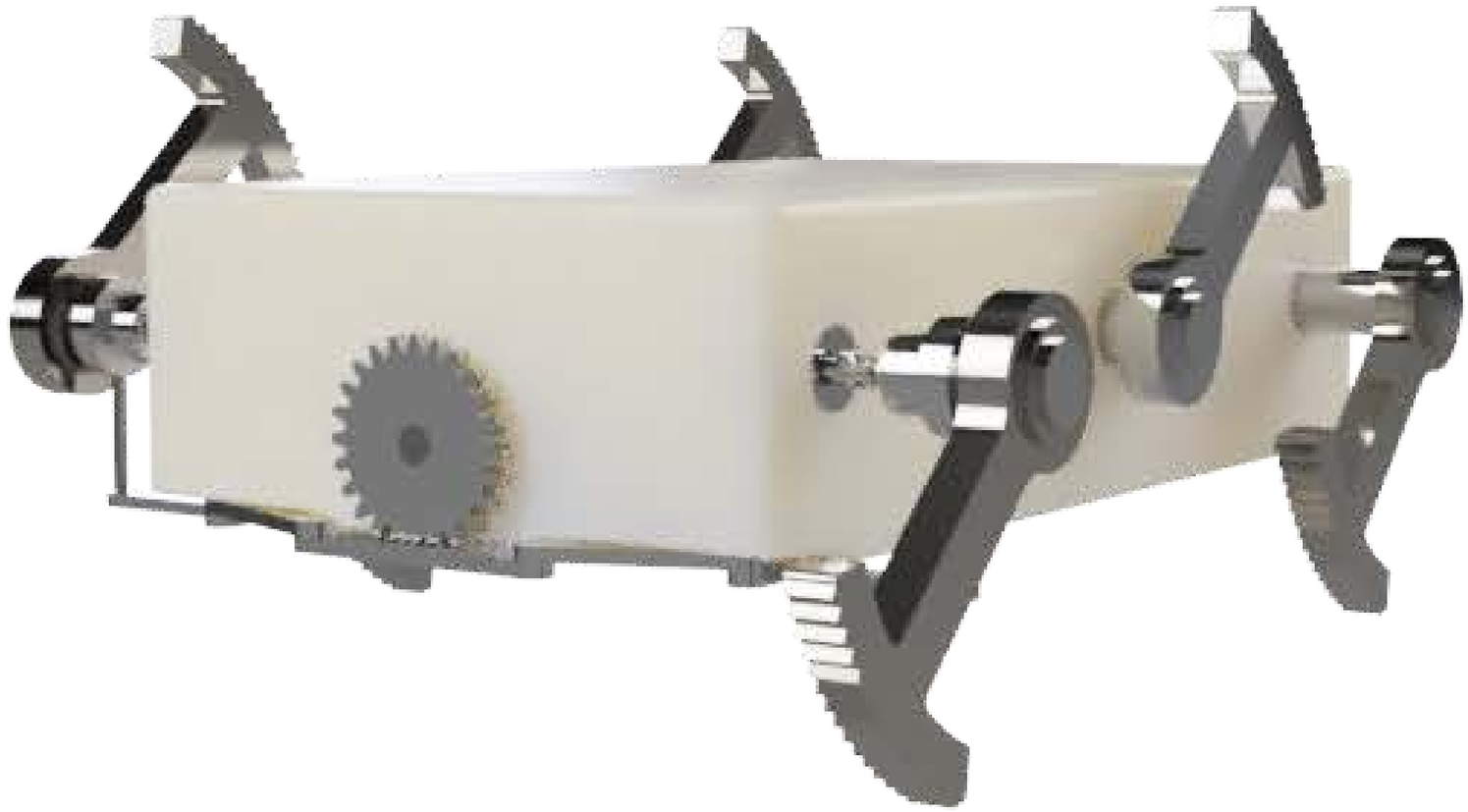




Final Concept

The final TACET product took all user feedback into consideration for functions and design.
Materials and components were also researched and sourced to find the most efficient yet cheapest ones, allowing for accessibility to our user group of students.

Component Selection · Manufacturing · KeyShot · Rendering
Hardware Design

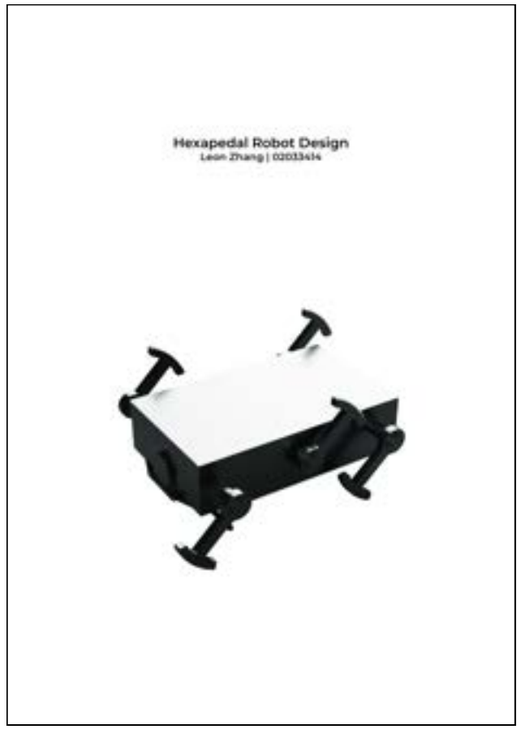


Hexapedal Robot

Designing the chassis and mobility system for a small hexapedal robot to manoeuvre through rough terrain

CAD · FEA · Ansys · Fusion 360 · Report
Electronics · Materials

Report



Summary

Brief

The aim of this technical report was to design the chassis and mobility system for a bio-inspired mini hexapedal robot, for locomotion in rough terrain.

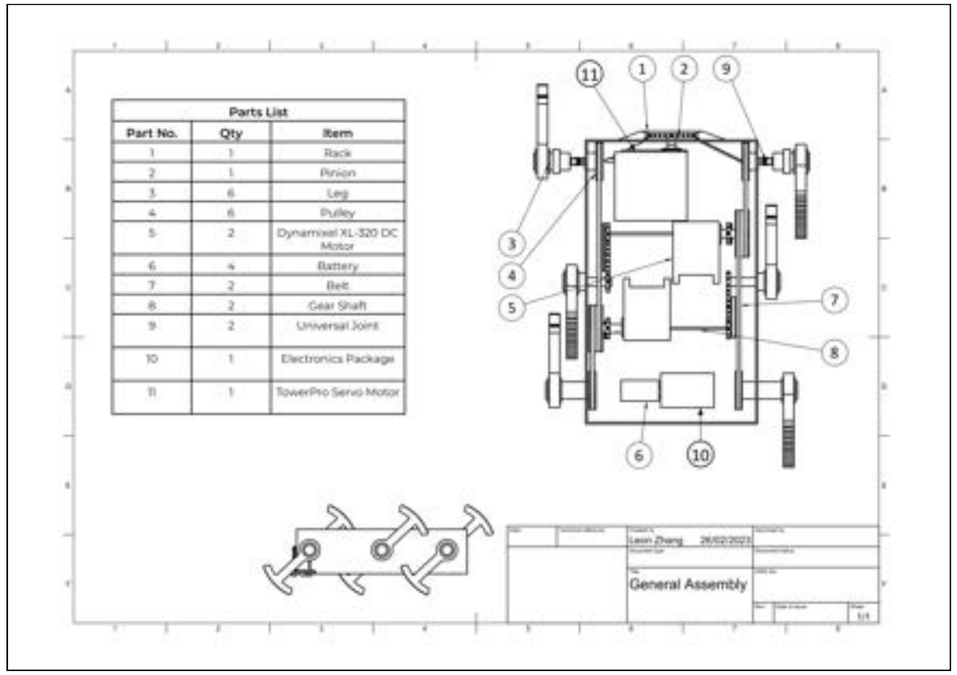
This report covers the process of designing the actuators, chassis design, steering mechanisms, and other aspects of producing a working hexapedal robot.

Results

The chosen design succeeded in meeting the cost limits, and ability to manoeuvre through the required terrain.

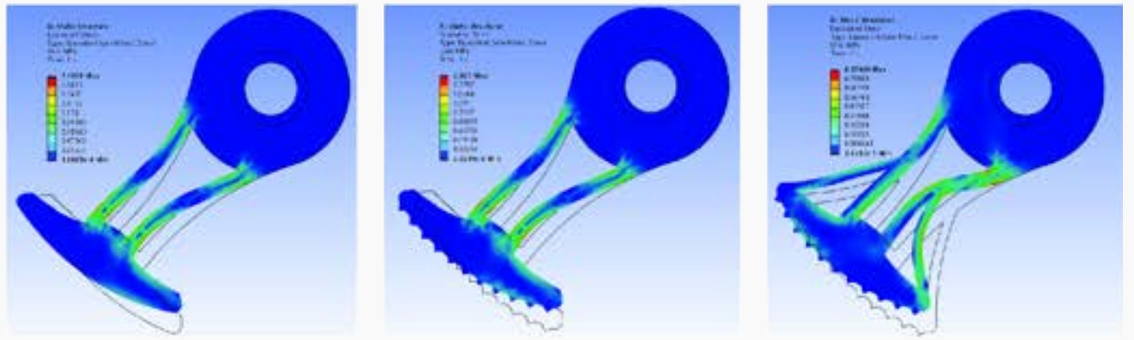
Full Report

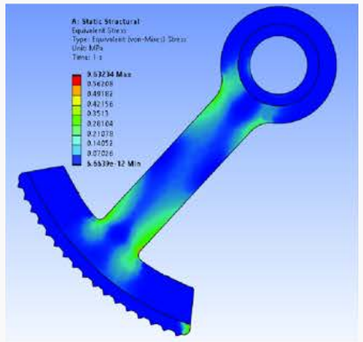
This full report is available on my website:
www.leonzhang.co.uk



Analysis

Actuator Development (Ansys)





The structural performance of the robot's actuator was improved through multiple changes to the arrangement and shapes, as well as the materials on the actuator.

These structures were stress tested on Ansys.

Mobility Design

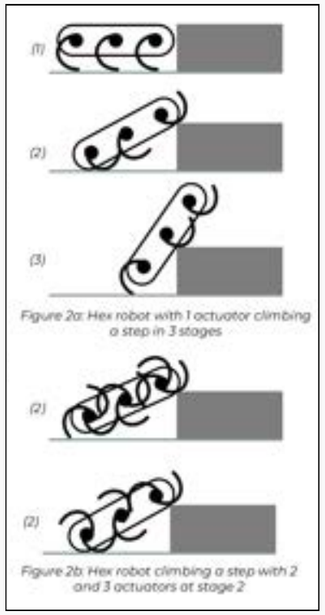
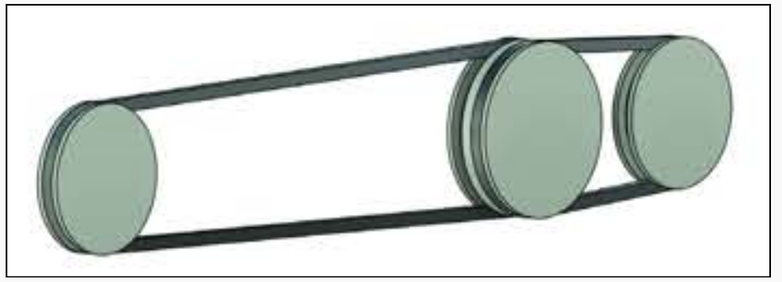


Figure 2a: Hex robot with 1 actuator climbing a step in 3 stages

Figure 2b: Hex robot climbing a step with 2 and 3 actuators at stage 2

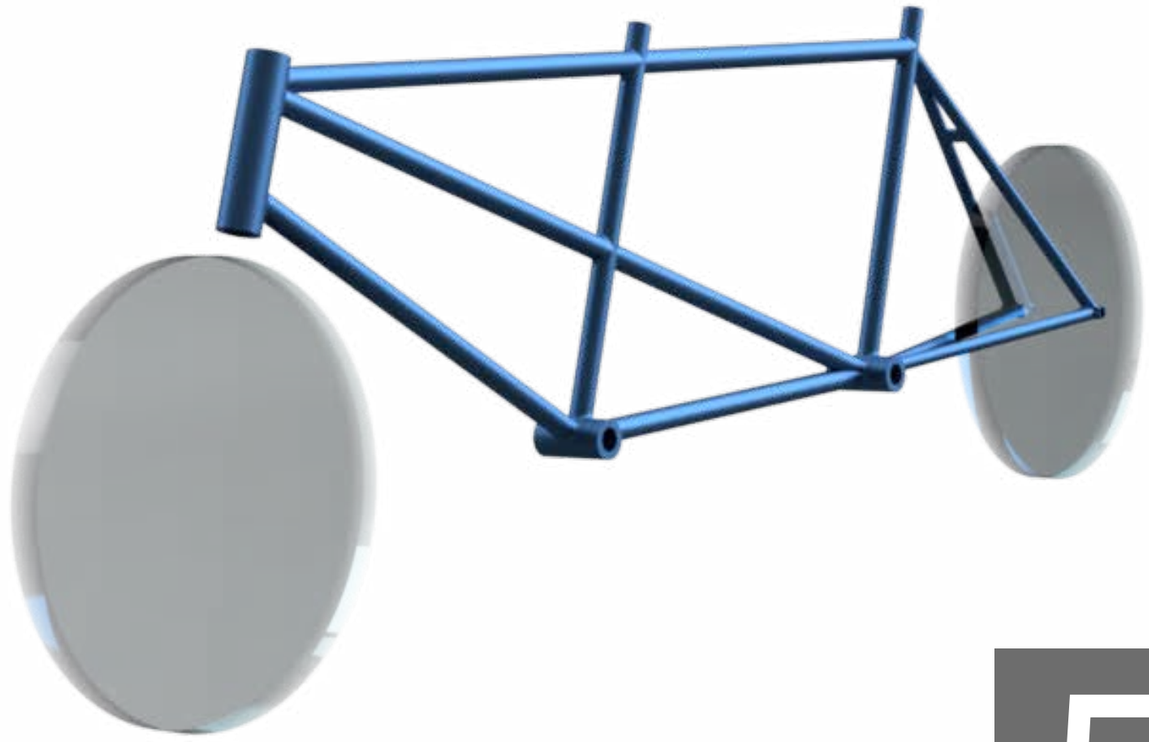


Mobility was improved through actuator numbers, belt and pulleys, and Ackermann steering linkages.

Tandem Bike

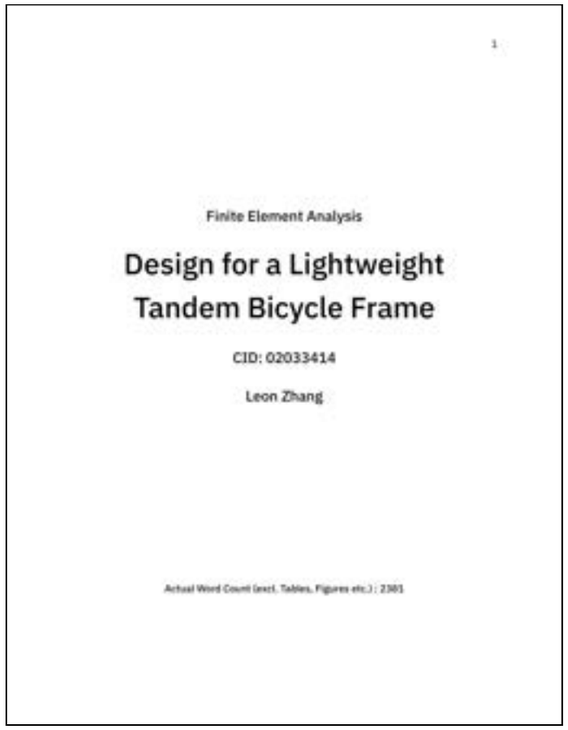
Conducting Finite Element Analysis (FEA)
to optimise a bike frame

CAD · FEA · Ansys · Fusion 360 · Report



5

Report


1

Finite Element Analysis

Design for a Lightweight Tandem Bicycle Frame

CID: 02033414

Leon Zhang

Actual Word Count (excl. Tables, Figures etc.) : 2301

Summary

Setup

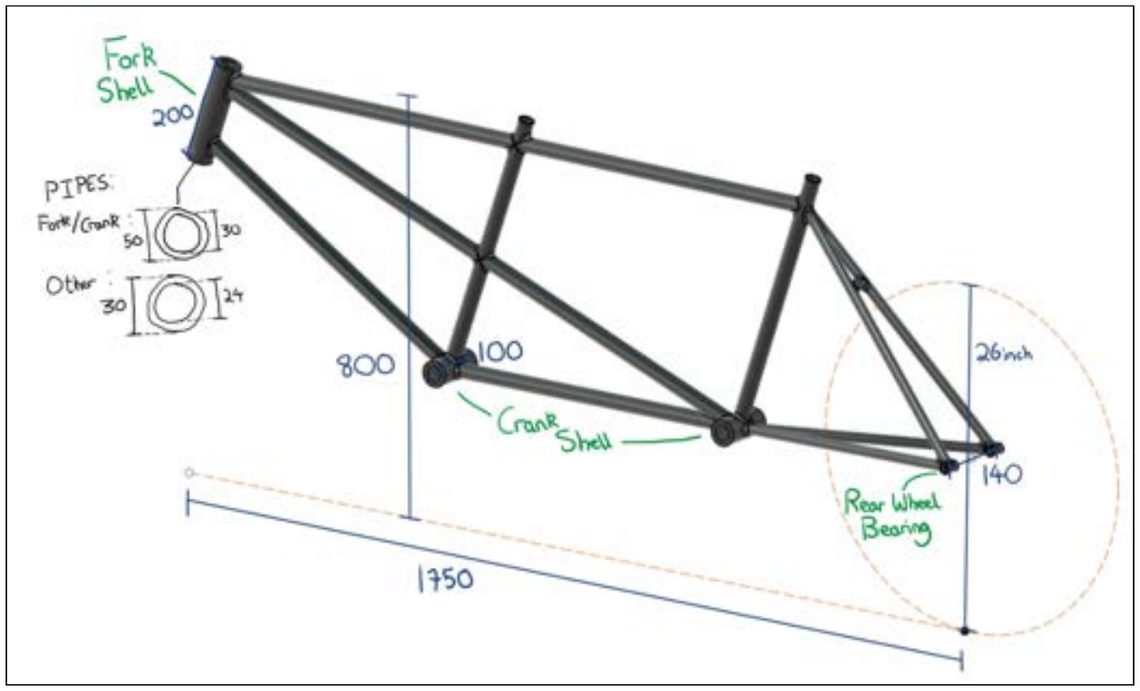
The frame was designed on Fusion 360, and imported into Ansys.
Boundary conditions were then applied to the model, involving loads and supports.
Before conducting tests, the mesh sizing was refined to produce more accurate results.

Results

After improving the frame design from the original model based on stress analysis, the final bike frame achieved the objectives outlined in the design brief.

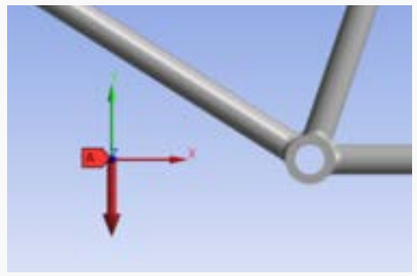
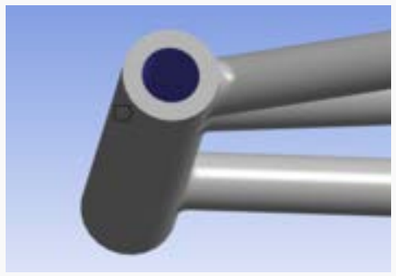
Full Report

This full report is available on my website:
www.leonzhang.co.uk

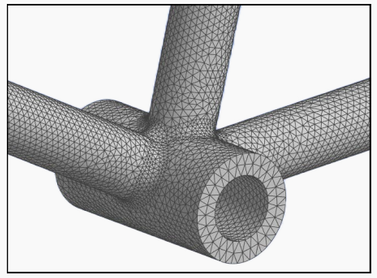
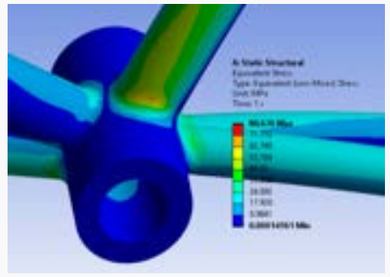


Analysis

Setup

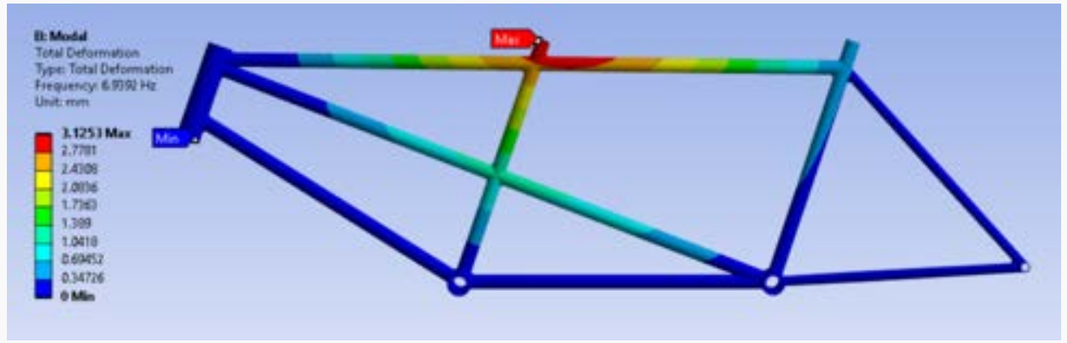




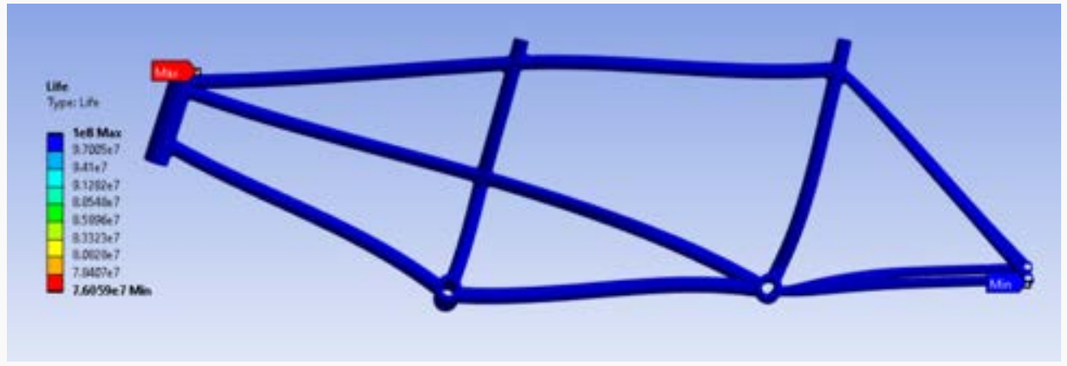
Meshing

Overall mesh sizing refined, with finer local mesh sizes at fillets due to higher stress in these areas.

Simulations



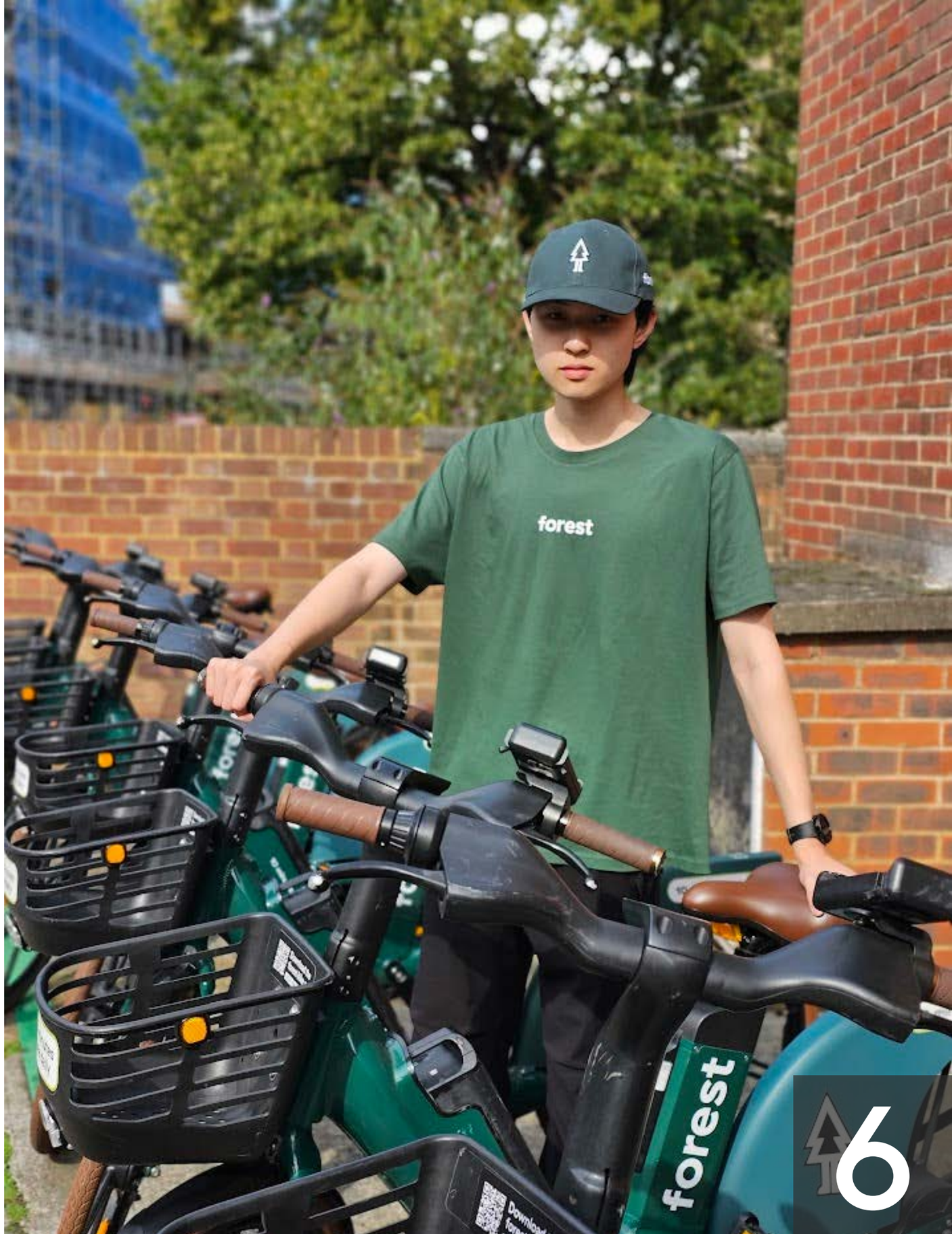


HumanForest

Design Engineering Internship for Forest's next eBike design

CAD · FEA · Fusion 360 · Figma · Ideation

NOTE: *All information and pictures have been limited to conform with HumanForest's NDA and confidentiality agreements.*



Role Overview

With Forest's provided design objectives, I developed multiple concepts through the use of ideation, sketching, CAD modelling, and FEA testing. These concepts were then organised on Figma and presented to Forest's clients and suppliers for physical development and future market rollout.
My role as a design engineer accomplished over a year of design and communication within just two weeks.

CAD · DFMA · FEA · Communication · Presenting

Learning Outcome

I improved my CAD Fusion 360 skills through learning different modelling techniques.
By consulting and discussing with other teams at Forest, I learned more technical information about eBikes, and managed to network within the company.

Networking · Communication · Surface Modelling

Contact Me

Leon Zhang

leon@zhang.co.uk

07480 478278

Leon Zhang

www.leonzhang.co.uk

@lcfz_design