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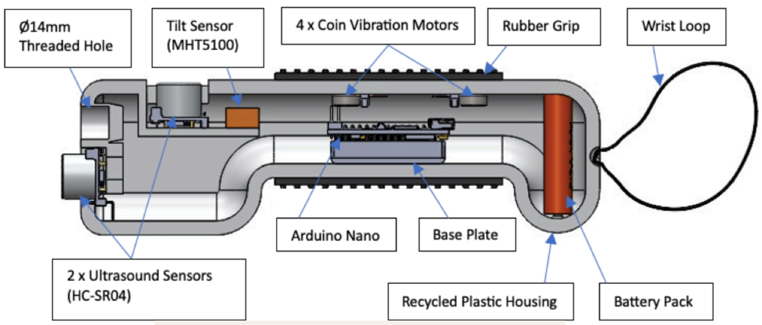
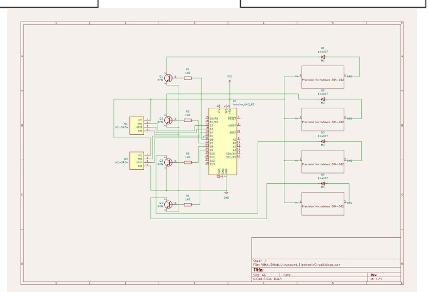
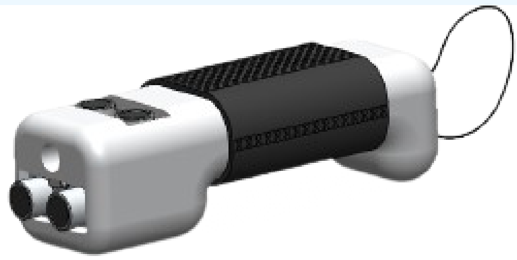
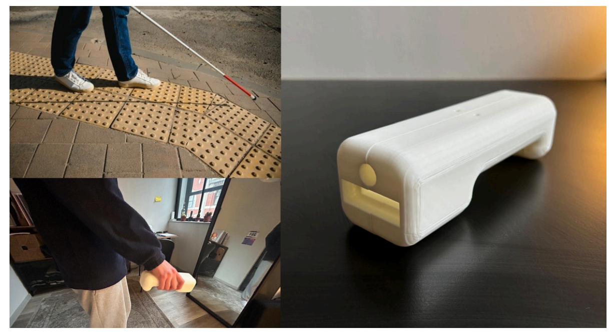
VIMA - VISUAL IMPAIRMENT MOTION ASSISTANT

*click the VIMA logo to learn more









What?

- VIMA is a detachable handle equipped with strategically positioned sensors and vibratory actuators, delivering real-time feedback to detect obstacles.
- It identifies overhanging objects and simulates the tactile sensations of a white cane.

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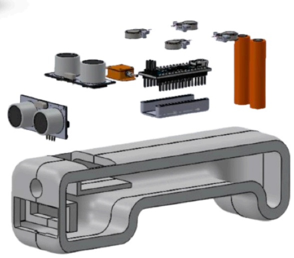
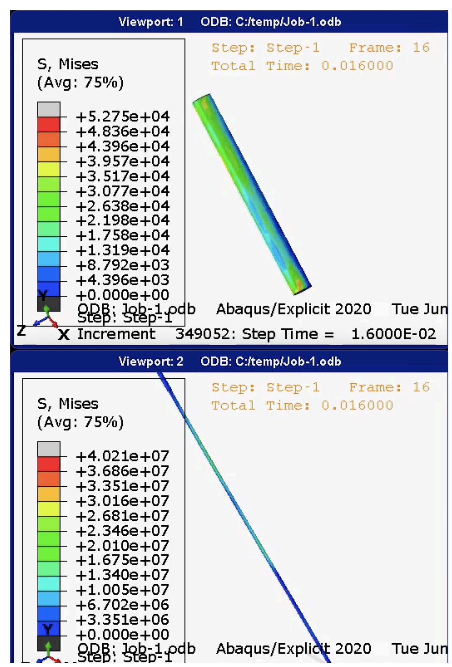
How?

- Designed 3D CAD models and created detailed 2D engineering drawings for VIMA's enclosure using SolidWorks.
- Developed the electrical infrastructure with Arduino and multiple sensors.
- Utilised rapid prototyping techniques, including 3D printing, for fabrication.

Results

- Outputted obstacle detection data and haptic feedback with a **95% similarity** to traditional white canes.
- Secured **£3700** grant from Sister, Manchester's Innovation District





1 Presence Detection → 2 Distance Measurement (Input) → 3 Distance Analysis → 4 Obstacle Detection → 5 Haptic Feedback (Output)

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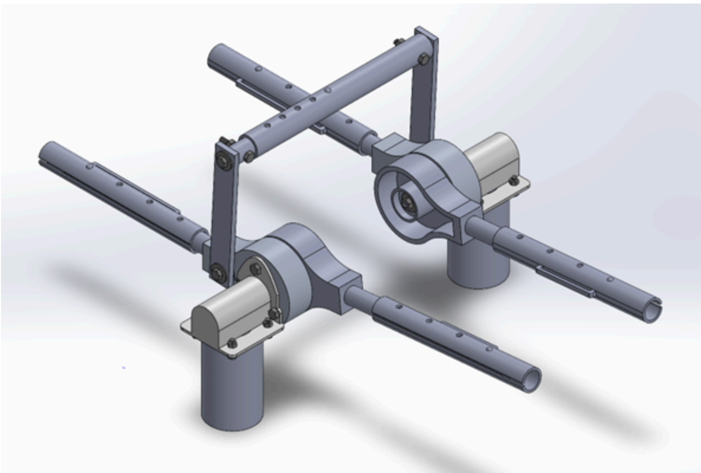
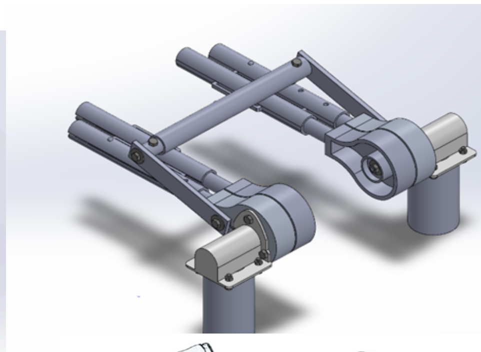
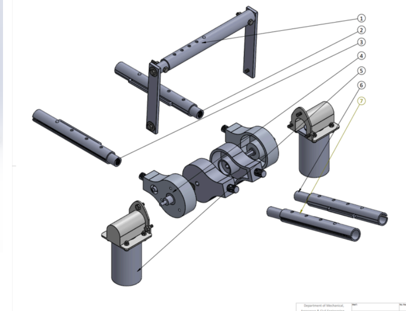
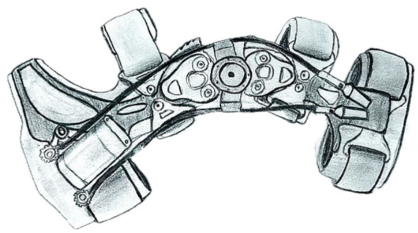
YEAR 4 DESIGN PROJECT









What?

- Designed a portable, home use knee Continuous Passive Motion device to support post operative rehabilitation by delivering controlled passive flexion and extension without active effort from the patient.
- Addressed the gap between bulky hospital CPM systems and low cost manual aids by prioritising portability, safety, adjustability, and clinically relevant motion control.
- Targeted independent use in domestic settings with a compact folding geometry, intuitive set up, and a user interface that allows range, speed, and session duration to be set and monitored.

.

How?

- Converted customer and clinical needs into a quantified specification, defining a motion range of −10 to 120 degrees and speeds up to 220 degrees per minute.
- Developed a final design using a folding frame with telescopic aluminium poles and dual-motor actuation to ensure portability and stability.
- Performed torque sizing for a 27.1 Nm worst-case load and conducted structural checks on the telescopic components to justify engineering decisions.
- Defined the control architecture using an Arduino-based interface with real-time angle monitoring and layered safety controls including emergency stop, limit switches, and software limits.

Results

- Outputted a portable, foldable design suitable for independent home use without clinical supervision
- Verified structural integrity of telescopic poles through FEA checks.
- Delivered a fully costed bill of materials, maintaining affordability compared to hospital-grade systems.

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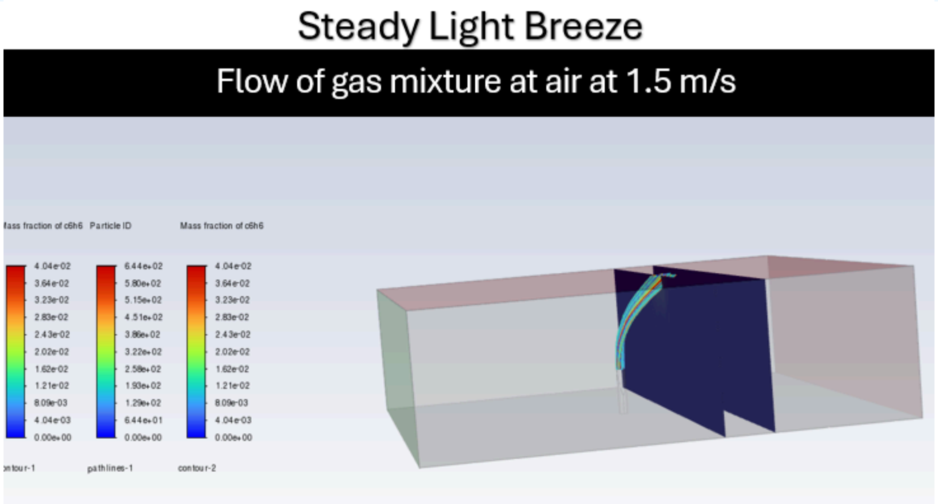
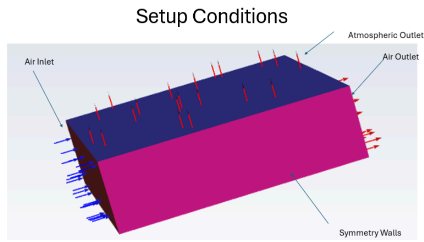
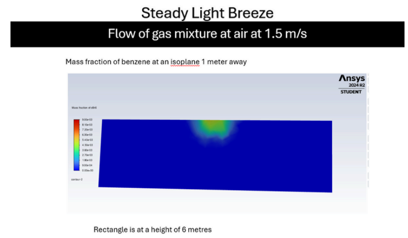
TANK MIXTURE DISPERSION CFD







What?

- Estimate mass fraction benzene vented out at nearby distances
- Prevent risk of workers inhaling carcinogenic benzene vapour

How?

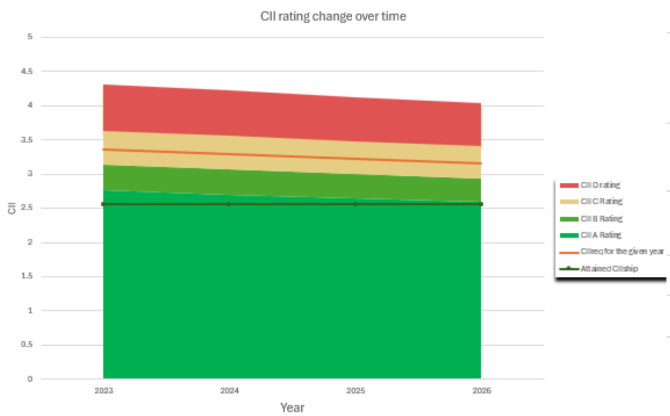
- Used Ansys Fluent Multiphase simulation.
- Post processed results using isoplanes to find mass fraction

Results

- It was found that since benzene was a lot lighter than air, unless directly above the pipe, it is very unlikely for someone to inhale, as it is effectively dispersed

CII RATING DASHBOARD

ATTAINED CIIship for 2023	ATTAINED CIIship for 2024	ATTAINED CIIship for 2025	ATTAINED CIIship for 2026
2.552989474	2.552989474	2.552989474	2.552989474



These are the CII ratings vessel will achieve if it maintains current operations

Year	CII Rating Achieved
2023	A
2024	A
2025	A
2026	A

What?

- Excel-Based CII Calculator: A compact, on-device tool for calculating carbon intensity.
- Simplified & Independent: Removes the need for a complex network-based version.

How?

- Used IMO(International Maritime Organisation) documentation and formulas.
- Considering the factors for a wide range of vessel and fuel types

Results

- Simplified work for all consultants
- Enhanced presentations to client and lead time to provide CII related services

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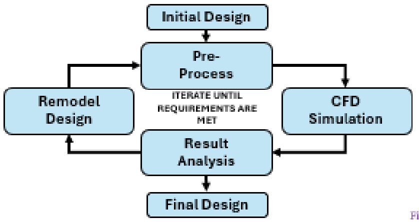
SOLAR CAR FINAL YEAR PROJECT



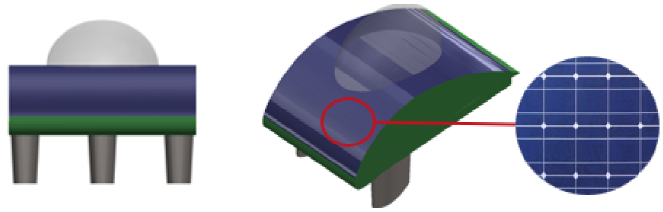


Fig 4: 3-wheel outer shell design chosen for analysis is based on a NACA 6412 aerofoil, with an ellipsoidal canopy for the cockpit and 3 wheel-fairings.

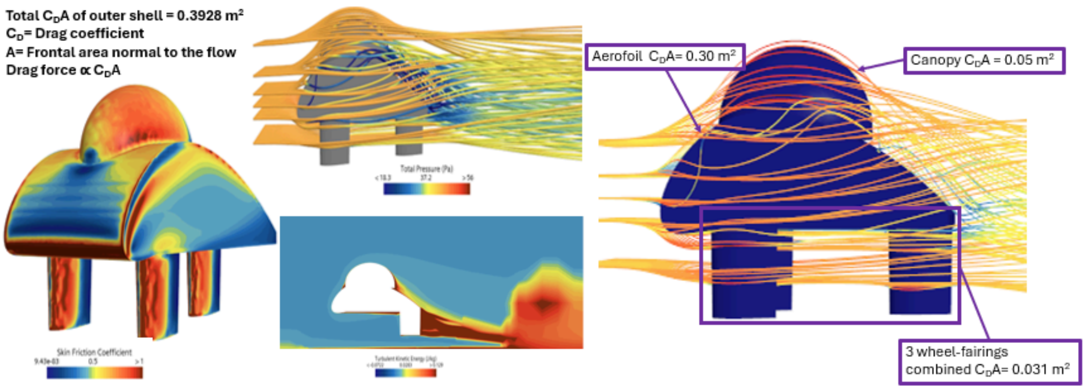
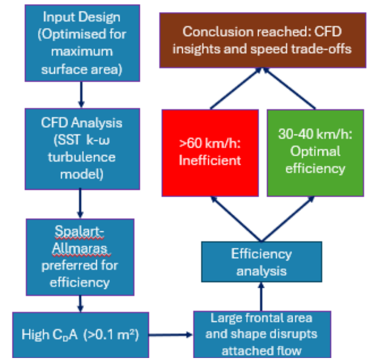
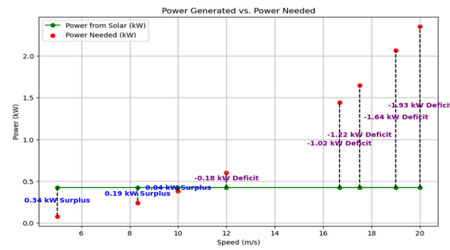


Fig 5: Flow features obtained by a CFD analysis.





What?

- I designed a solar car outer shell to minimize drag and maximize solar panel area.
- I developed a concept to enhance the vehicle's overall energy efficiency.

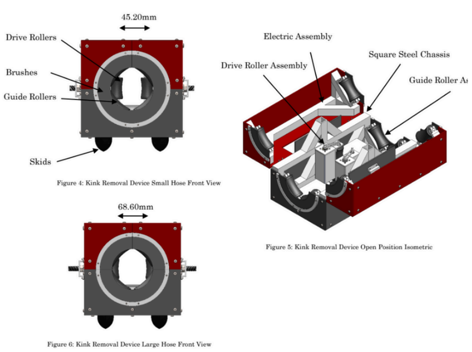
How?

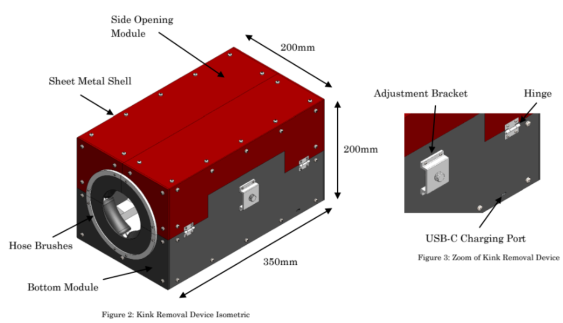
- I conducted CFD simulations using SST k-ω and Spalart–Allmaras turbulence models.
- I integrated a Python model to evaluate efficiency by factoring in rolling resistance, solar power data, and benchmark comparisons.

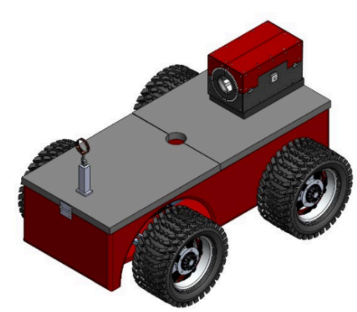
Results

- I achieved improved aerodynamic efficiency at optimal speeds (30–40 km/h).
- I demonstrated higher energy performance, with further wind tunnel testing planned.

YEAR 3 DESIGN CHALLENGE







What?

- Designed a two-part firefighting device that integrates a kink removal system with a hose advancer.
- Project aimed to optimize hose management, improving both efficiency and safety during fire suppression.

How?

- Used a rigorous selection matrix and iterative design modifications to refine our concepts.
- Modular system features mechanical components such as guide and drive rollers, a hinge mechanism, and a rack-and-pinion steering system.

Results

- The final design delivers enhanced hose handling, reducing manual labor and boosting operational reliability.
- It meets sustainability goals by incorporating eco-friendly materials while significantly improving firefighter safety and efficiency.

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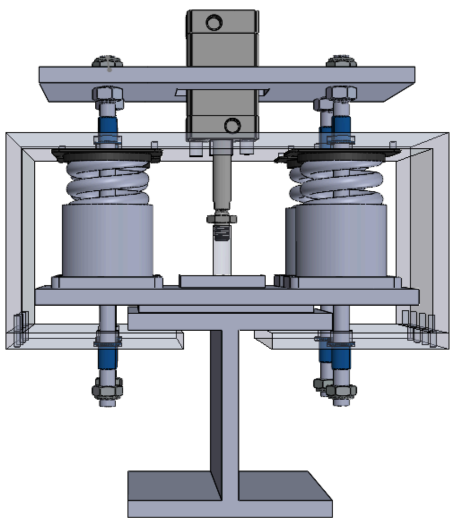
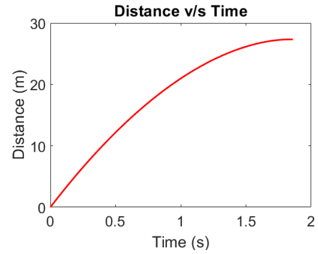
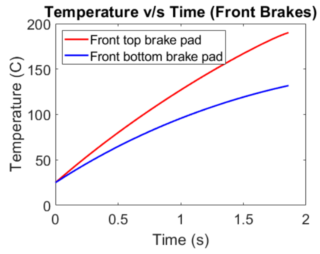
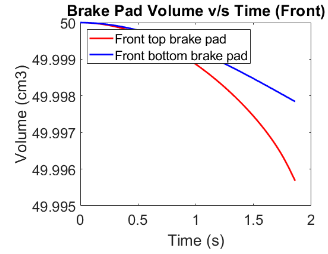
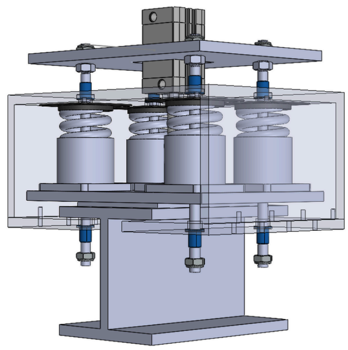
HYPERLOOP - HYPERLOOP MANCHESTER

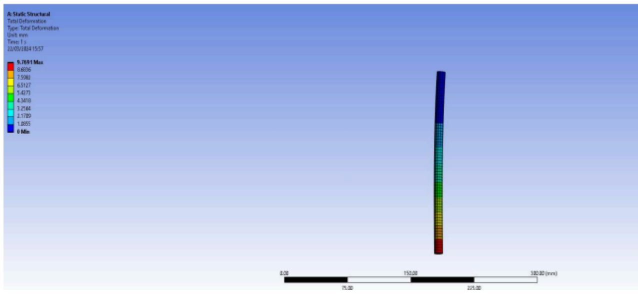












What?

- Designed Hyperloop Braking System
- Small scale demonstration model

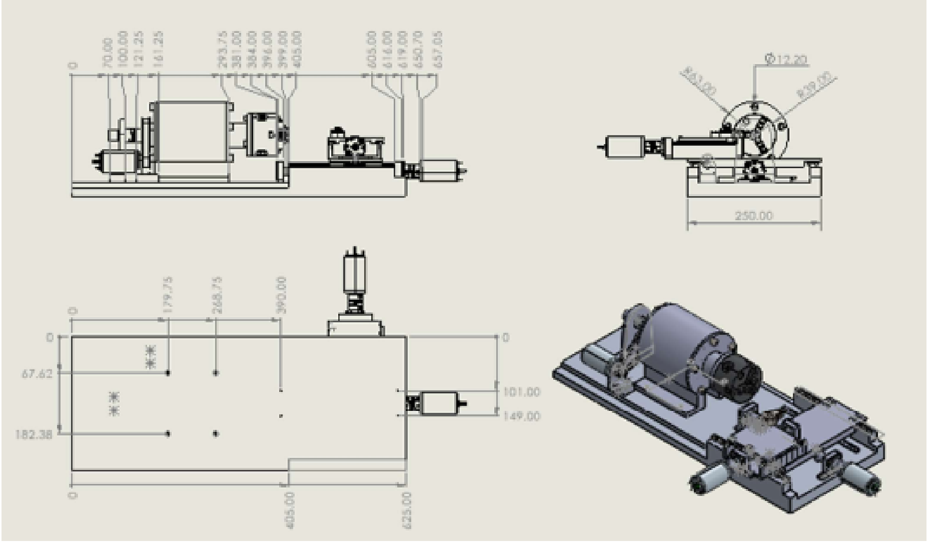
How?

- Used **SolidWorks** to design braking system assembly
- Used **ANSYS** for FEA simulation of braking rods for deflection
- Conducted material research on brake pads and ran MATLAB models to assess their effects.

Results

- Designed a highly efficient braking system capable of working with only 1 pneumatic actuator.
- Passed EHW safety regulations

LATHE



What?

- Designed a lathe with a 3 jaw chuck

How?

- Used **SolidWorks** to design this due to the lathe's complex geometry and multiple components.
- Calculated cutting force, spindle bearing loads and deflection.
- Applied **GD&T** on all drawings

Results

- Calculations confirmed the lathe's ability to handle cutting forces and spindle loads.
- GD&T application ensured precise manufacturing and assembly.