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Prototype Electric Vehicle

Formula SAE Electric Car

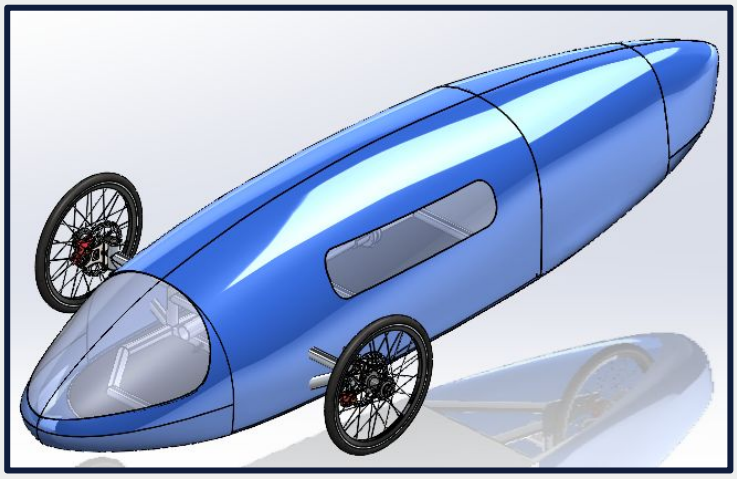
Smart Glasses

School Design Projects

School Coding Projects

3D-Printing

Prototype Electric Vehicle

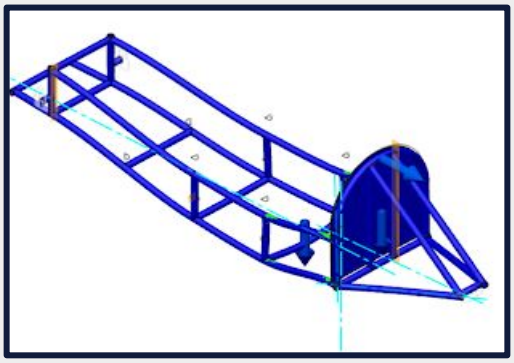


Full CAD Assembly in Solidworks

From 2019 to 2021, a team of engineering students and I decided to compete in the **Shell Eco Marathon** to design and build an ultra efficient, prototype, battery electric vehicle. From founding the school club to earning 1st place high school team internationally, I have matured in utilizing design softwares like SolidWorks, applying the iterative design process using simulation softwares, learning about different manufacturing technologies, working with manufacturers and sponsors, and managing projects of various scales.

As one of the mechanical leads, I focused on the chassis design as well as shell design and fabrication. The chassis of the car is made of 6061 aluminum tubing, a material with a high specific strength and geometry that can withstand loads in multiple directions with less mass.

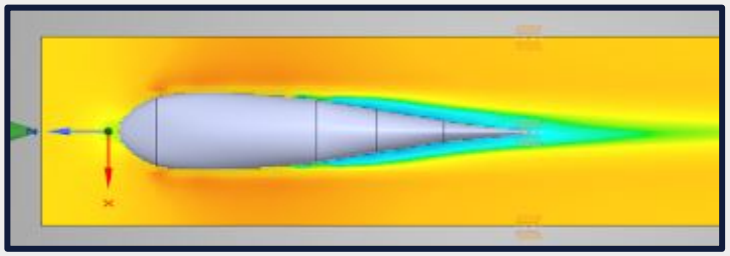
The overall frame has been iteratively optimized by reading relevant research papers, designing a concept in CAD, simulating our loads with Finite Element Analysis, and making changes based on the simulation outcome. To ensure the ergonomics of the frame were sound, we built a wooden prototype and adjusted dimensions accordingly before moving to the final design. After countless iterations, I achieved a lightweight frame design (<30lbs) that would pass the competition's rigorous loads assessment.



Stress Simulation of an Early Iteration in Fusion 360

Complete Frame with Base Plate, Bulkhead, and Rear Dropouts

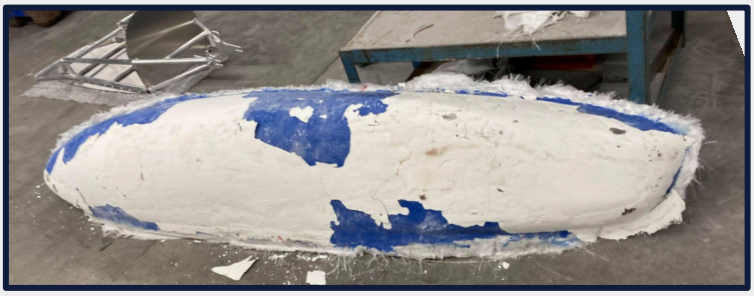
Prototype Electric Vehicle (continued)



Flow Simulation of Potential Airfoil of Top Profile

The shell design was iterated in a similar way but using SolidWorks Flow Simulation to simulate different airfoils aimed to reduce to drag. With the limitation of each body panel taking more time and resources to fabricate, we finalized on a partial teardrop design that would allow us to only make two fiberglass layups, one for each side of the car. The shell fabrication process was very exhaustive, spanning many months of labour. The process started with producing female molds out of high-density foam, which were 3-axis milled by a local manufacturing firm. We then prepared the mold for the exothermic reaction of epoxy by coating the mold in layers of body filler. After, we laid our layers of fiberglass along with polyester resin and let it cure. Finally, we extracted the two pieces and joined them together to create the full shell.

Initial Layer of Fiberglass Laid with Resin



Left Half Removed From Fold with Plaster from the Mold

Final Shell With Halves Bonded Together

In the 2021 virtual competition, we placed third among all teams in the Americas region and first among all high schools internationally. We have been commended by Silicon Valley Clean Energy which also sponsored us $10,000 and have been recognized by the City of Saratoga.

Formula SAE Electric Car

2022 IFE Car

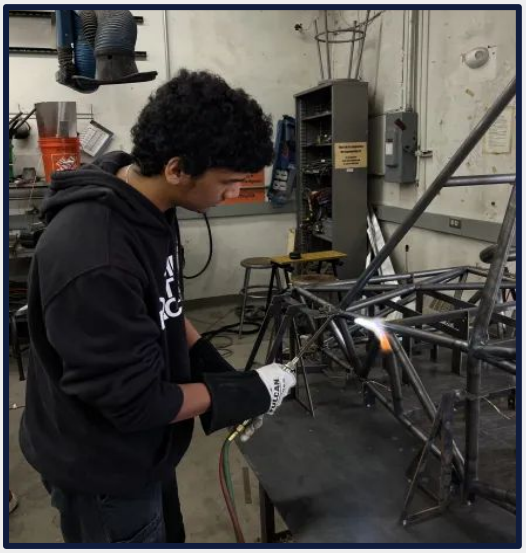
2023 Chassis Design With Steering System

From 2022 to 2023, I joined University of Illinois's Formula Electric team. As part of the chassis team, I was tasked to strengthen the steering system support members which wiggled under forces from steering the car. After running Finite Element Analysis on the previous design and looking at displacement and Factor of Safety plots, I created a design that reinforced the steering columns while abiding by the design rules outlined by SAE.

Improved Steering System

The manufacturing step of this project involved designing and water jetting a steel jig to hold the components while welding. This was done successfully and the steering system was accurately manufactured and assembled in the final car.

Testing Fit of Steering System to Rest of Chassis



Me Normalizing Fresh Chassis Welds

Smart Glasses

Over the summer 2024, I designed and built a smart glasses concept. The idea is to have an electronically deployable screen attached to your glasses and can be used with any computer application (video calling, watching a cooking guide, AR applications, etc). I built a 3D-printable mechanism coupling a 4-bar linkage and a crank-slider to extend and rotate a 1.8" LCD screen. A servo motor is used to actuate the mechanism with PWM using a push button. The screen and the servo are controlled with a Raspberry Pi, which sits in your pocket in an enclosure.

Over Fall 2024, I will be developing a push-latch locking mechanism to keep the glasses attachment stationary in deployed and stowed position, without the reliance on static friction.

Smart Glasses In Deployed State With Pi Enclosure

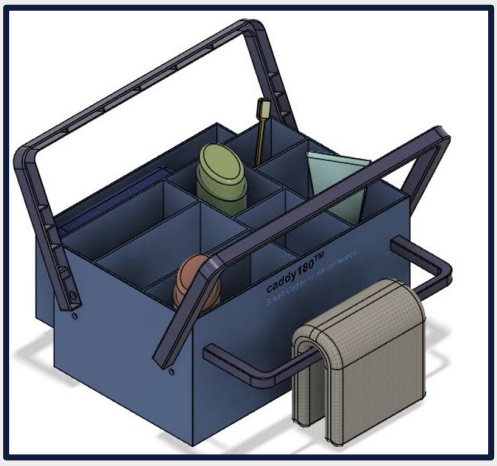
Smart Glasses In Deployed State

Testing Screen Wiring; Smart Glasses in Stowed Position

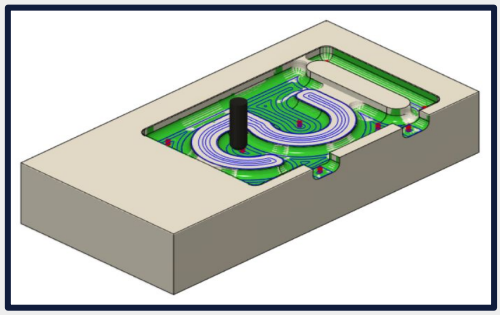
School Design Projects

ME 170: Computer-Aided Design

In this college course, a team of myself and two others ideated and designed a consumer product in Fusion 360. Using Human-Centered Design, we made a shower/toiletries caddy that has handles that can turn 180 degrees to act as a stand, which is especially useful to college students using communal bathrooms.



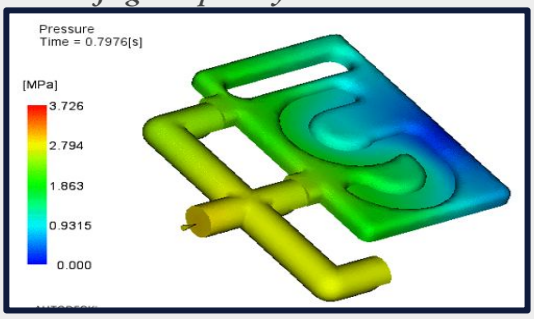
ME 170 Project: Caddy 180



CAM of "g" shaped keychain in Fusion 360

ME 270: Design for Manufacturability

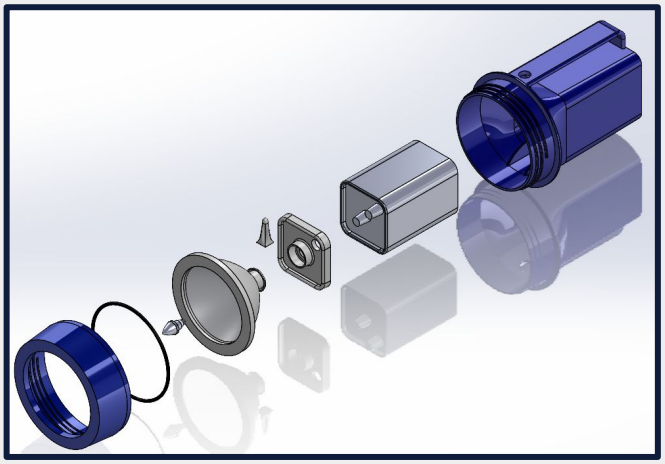
For this college course, we work on multiple labs relating to different manufacturing methods. One manufacturing method we focused on was injection molding, where I designed a keychain, created tooling paths in Fusion 360 CAM and simulated the molding result with different temperatures and pressures in MoldFlow.



Pressure Plot of keychain in Moldflow

DMT 60: Intro. To SolidWorks

In this summer community college course, I had a formal education of SolidWorks outside of projects. This course guided me to make parts, assemblies, and drawings using a multitude of features offered by SolidWorks.

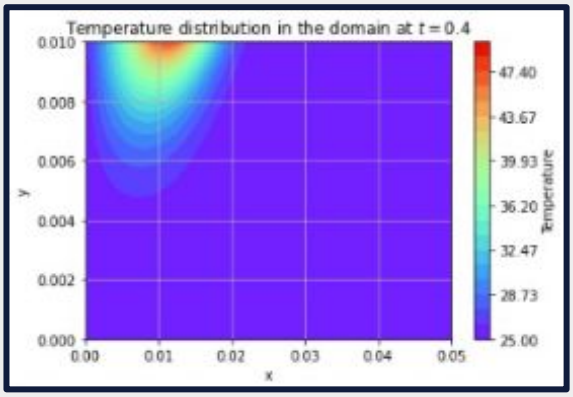


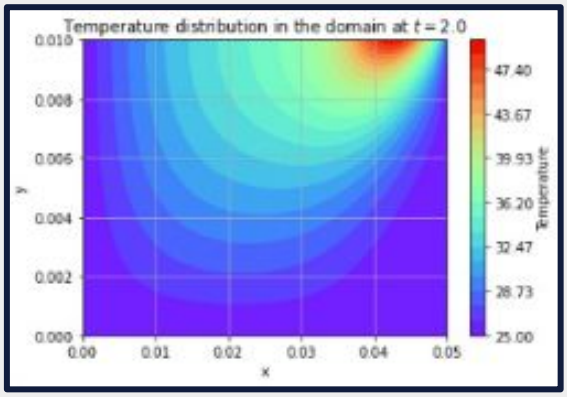
Assembly of a Flashlight that I Modeled in DMT 60

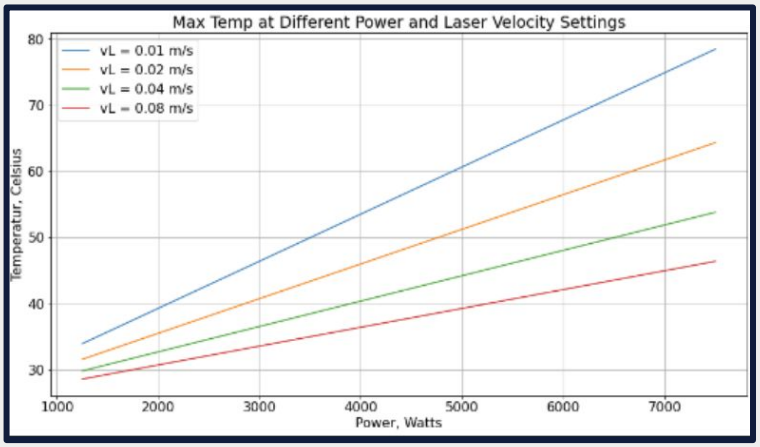
School Coding Projects

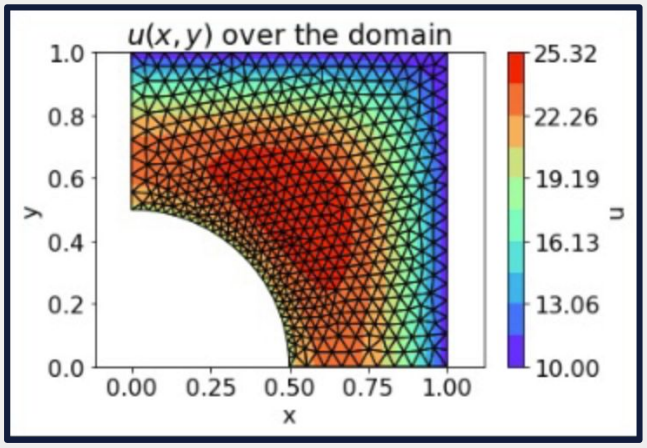
TAM 470: Computational Mechanics - Laser Cutter

In this college course, I got to work on several coding projects, including modeling the temperature distribution of laser cutter bed. In Python, I implemented a 2nd order central-difference scheme on a 2D transient heat equation, where I modeled the laser as a Gaussian function moving across the far end of the bed. Plots of the heatmap over time were made, showing the diffusive nature of the laser cutter. Additionally, I looked at how different powers and speeds of the laser could affect the max temperature, which could be a useful relationship when deciding how to operate a laser cutter.







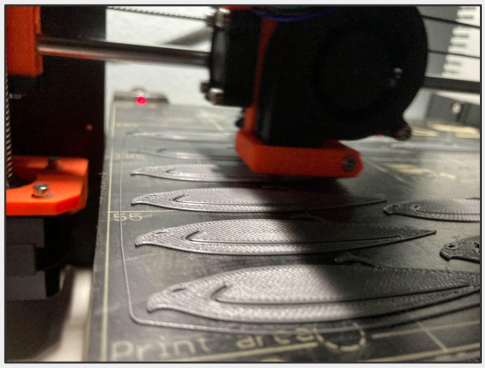


TAM 470 - 2D FEA

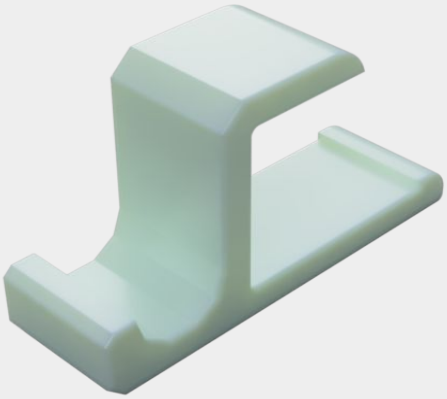
Another interesting project from this course was implementing the finite element method on 2D meshes. I modeled the steady state temperature distribution on a corner pipe object with some heat is applied, and additionally holding the arch, top, and right edges at constant temp. Applying the heat equation, FEM, and boundary conditions, I arrived at the displayed result.

3D-Printing

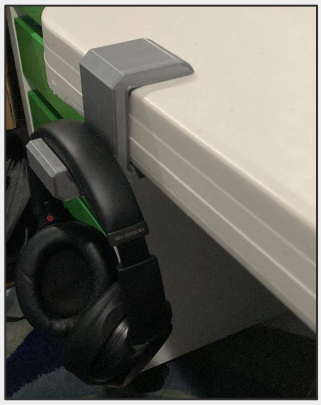
In my free time, I like to design and 3D print my chaotic creations. Here are just a few of the things I have printed on my Prusa i3 Mk2s.



3D-printer Printing Falcon Logos for the Prototype Electric Vehicle Team

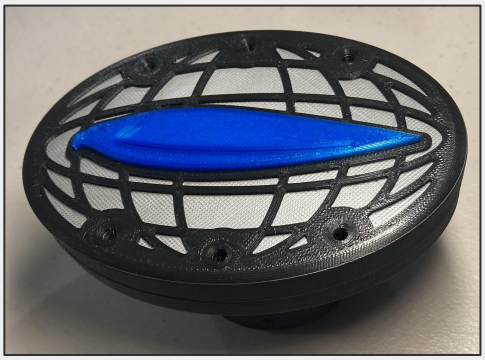


Design of Headphones Holder

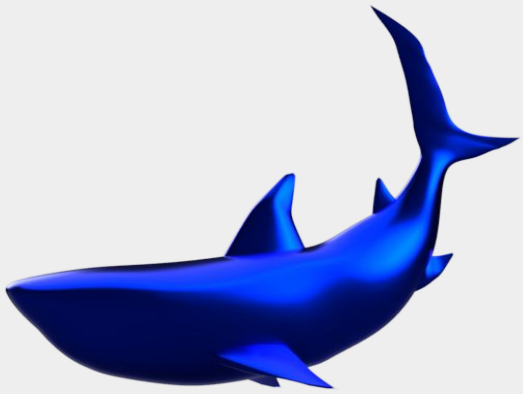


Headphones Holder In Use

Design of iPhone 6 Later Printed in TPU Plastic



Multi-Color Print of Steering Wheel Holder for Electric Vehicle



Design of Great White Shark With Fusion 360 Form

Raspberry Pi + Smart Glasses Electronics Case

Design of Mobius Strip Bracelet

Side View of Small Scale Print of Prototype Electric Vehicle

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