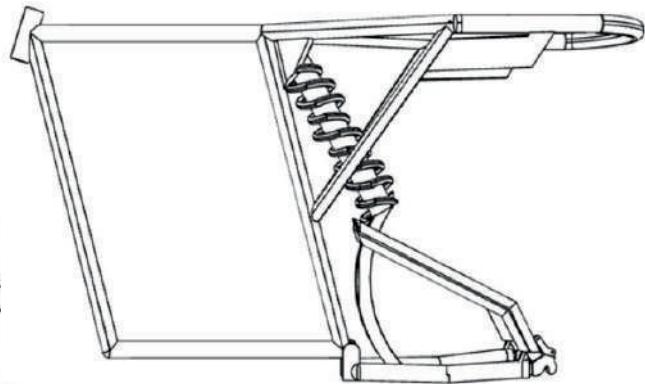
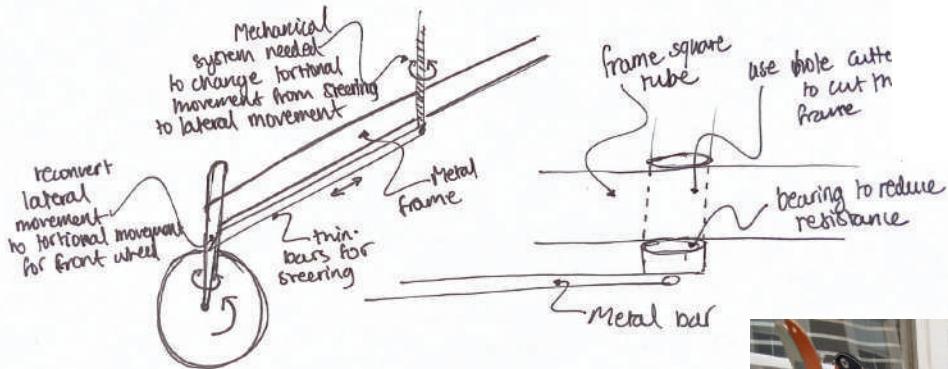


DESIGN & ENGINEERING PORTFOLIO

2014 - PRESENT

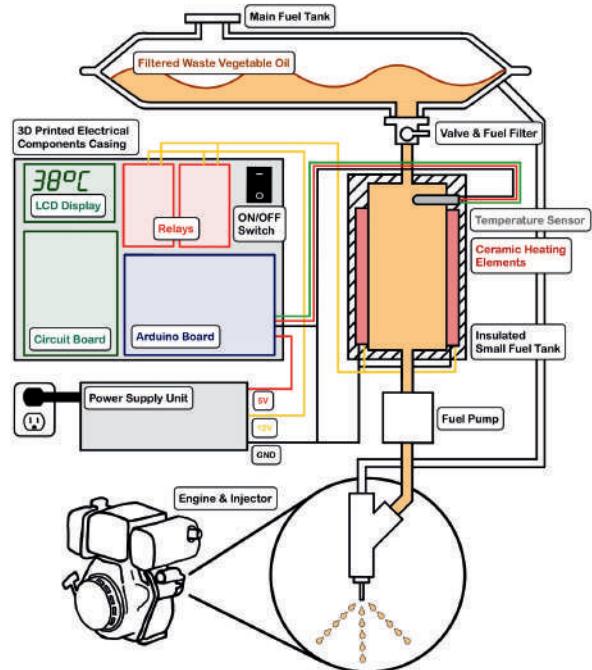
This portfolio is the culmination of years of design work in my free time and in class.



Highlights: BioMoto & preheater, skateboard 3.0, recycled ski shelf, drift trike and electric motorbike development



My team presenting our heating system at Design and Innovation Day



Vegetable oil preheating system diagram

PREAHEATER V1 IN-CLASS PROJECT JAN 22-APRIL 23

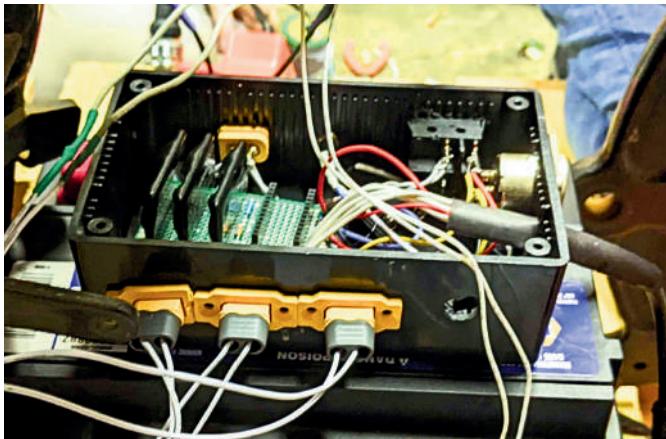
- Designed and built an auxiliary fuel heating tank to avoid injector clogging
- Thermocouple and programmed system to maintain temperature @ 70°C
- LCD display to alert the user when the engine is ready to start- Arduino Uno
- SolidWorks designed + 3D printed electronics housing
- Auxiliary heating tank acts as intermediary between main tank and fuel pump



System prototype installed on generator



Simple thermocouple design on our TIG welded steel tank



Preheater control unit



Waterjet gearbox mounting plate

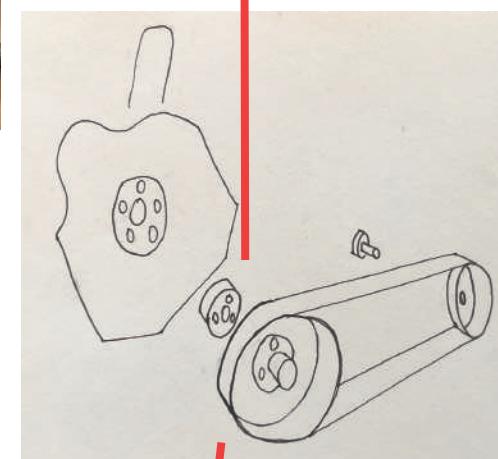


machined custom Diesel engine - Harley Davidson adaptor



BIOMOTO V1 + PREHEATER V2 SEPT 23-PRESENT

- Designed modular preheater in coordination with stakeholders to fight winter gelling of biodiesel
- Integrated heads up display panel, hands-free temperature maintenance at 18 °C
- Kill switch, custom 30A circuit board, hassle-free vehicle battery installation
- Personal project extension: 25hp diesel tractor engine swap onto 1999 Harley Davidson
- Custom CNC waterjet transmission and vehicle electronics



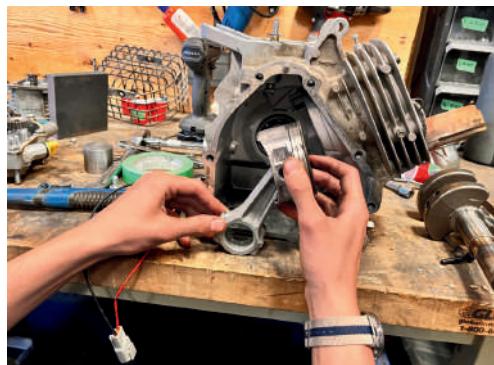
Ideation of open belt primary transmission- May 2024



Diesel engine in Harley frame- August 2024

What's next:

1. Finish motorcycle created with diesel engine
2. Install team's biodiesel preheater
3. Ride it from Vancouver to CA, US



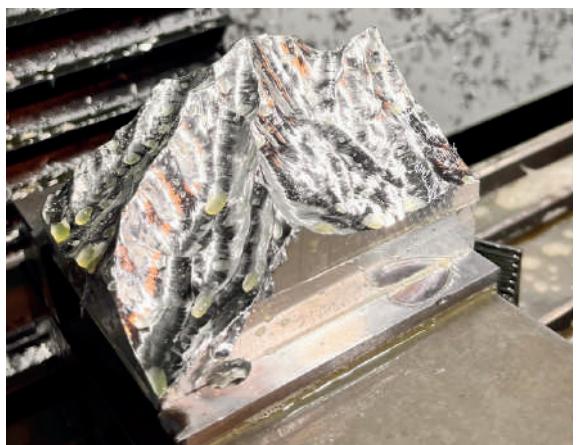
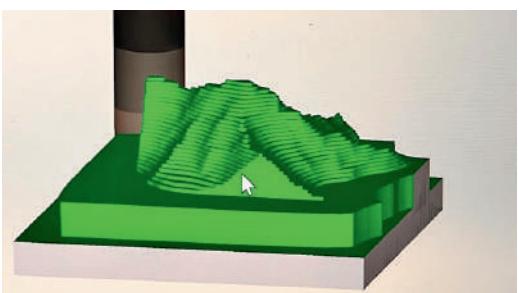
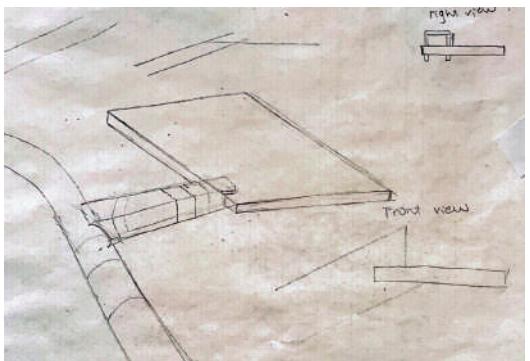
BAJA SAE DESIGN TEAM

+

CNC MOUNTAIN PERSONAL PROJECT

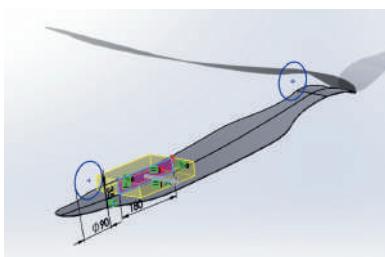
SEPT-DEC 2022

- Designed an engine mount to tab mount to the aluminium frame
- Design considerations included: transmission shaft output angle and strength to weight ratio
- Learnt about crankshafts and the intake valve timing mechanism
- CNC machined my brother's favourite mountain in the French Alps for Christmas!





Battery case has a charging port, battery indicator and on/off switch



Welding the battery together

Complex CAD work with my school teacher

ELECTRIC SKATEBOARD 3.0 2018-2019 + 2022 UPDATE

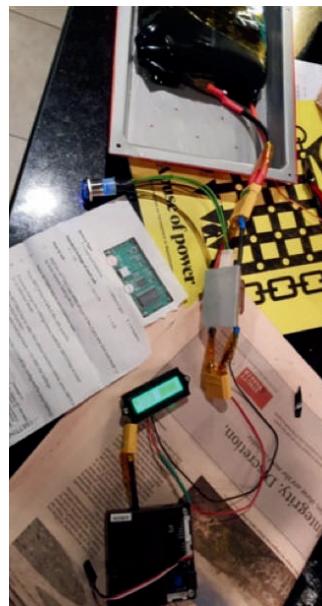
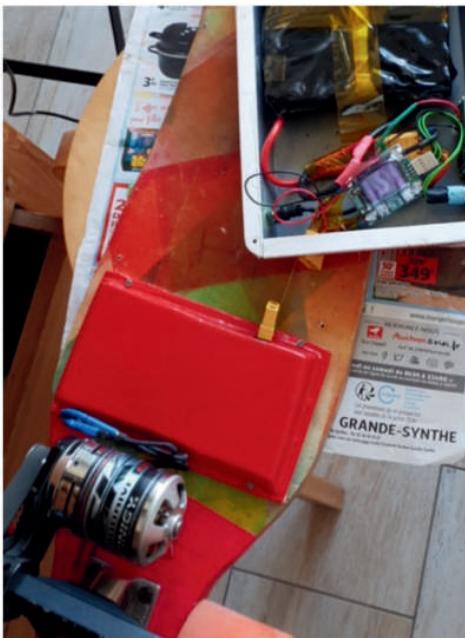
- Custom 10s3p spot welded battery pack with BMS
- Designed a longboard on SolidWorks (CAD)
- Programmed CNC router tool pathway for the battery casing & longboard moulds
- Layered bamboo and maple veneer with glue in the mould then compressed with 3 tonnes
- CAD-designed battery casing; fabricated it with carbon fibre and resin by hand layering and polishing
- Reconfigured electronics and battery to allow for deck flex (refer to page below)



Stronger welds and a new form factor - battery is modular



Series and parallel welded nickel between cells



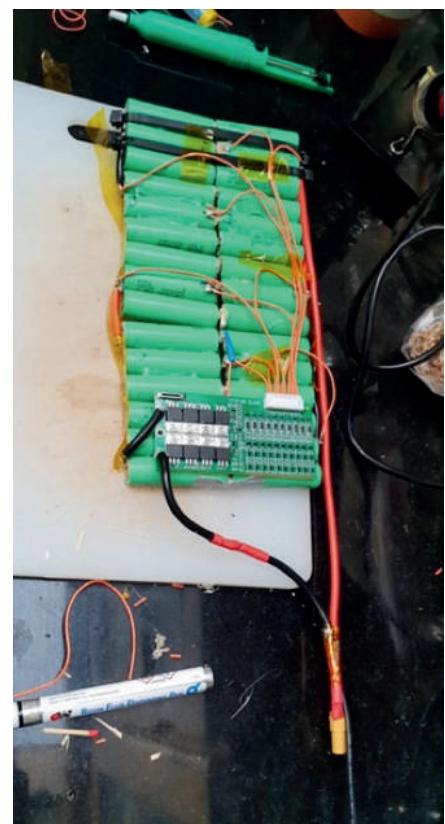
Battery percentage indicator on/off switch and VESC controller



Self enclosed system, need only plug in charger

ELECTRIC SKATEBOARD 2.0 2017-2018

- Upgraded motor and mount
- Increased the tooth size by changing the belt and motor/wheel pulleys- solving belt slip and power transfer problems
- Replaced the ESC (refer to page below) with a VESC, which allowed me to program battery and motor protection, regenerative braking and acceleration/deceleration curves using open-source software



Bad quality welds required zip ties to hold battery together



first electric
skateboard age 13



Wheel hub
scraping against
motor mount



Soldered battery
harness to
combine batteries
in series

ELECTRIC SKATEBOARD 1.0 2016-2017

- Electronics intended for an RC plane
- The ESC was not programmable: fixed acceleration curve, no max/min voltage/amperage draw
- Batteries had to be charged independently and were very hard to manage and use, Li-Po batteries are notoriously volatile
- A 3D printed motor mount and holder bent under torsional force so was replaced with an imported motor mount which required a new conversion plate



Motor upgrade
required for
different battery in
skate 2.0



Weak welds from
this spot-welder so I
tried to make my
own -->

DIY spotwelder with
car battery and
solenoid



Collapsible table

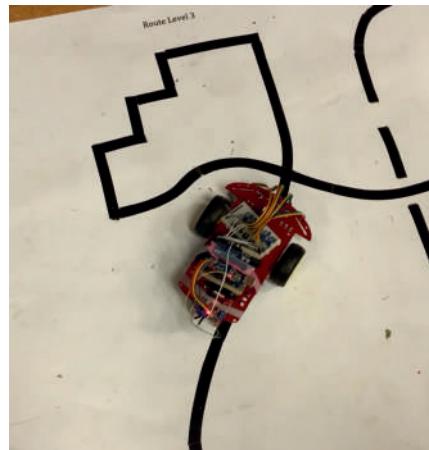


PERSONAL PROJECTS

2018- 2019 + 2022

- I tried to build a battery spot welder using a car battery and solenoid switch in view of making a battery pack with a battery management system (BMS) and on/off switch
- Collapsible wood and metal table, custom made for a client
- T- connector CAD designed, plasma cut and tubing was flow drilled to increase surface area to tap screw hole
- Integrated engineering line following robot class project- arduino uno, breadboard, IR sensor and C++

Used welder and
plasma cutter for
connecting plates





Vanity unit and sink



My first substantial project when I was 12. made with help from my uncle



PERSONAL PROJECTS

2018- 2019

- Bathroom vanity unit in oak, custom made for a client. joined using a miter joint. Floating effect, wall mountable
- Ski boot shelf, made from old skis and reclaimed mahogany
- Chest of drawers- made with walnut, plywood and maple veneer. I tried to use as much CAD automation and CNC routing as possible (for the drawers and side pannels) to increase precision

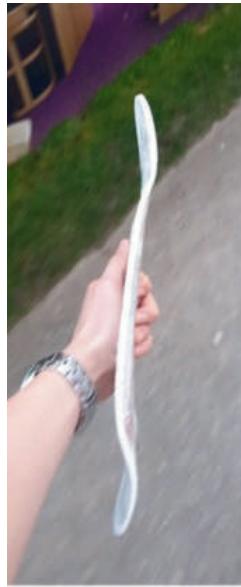




SCHOOL PROJECTS

2018-2020

- Foldable aluminium lamp- CAD designed, cut sheet aluminium with a plasma cutter, used a grinder to achieve brushed look
- Spindle back chair- Used a CNC router and bandsaw to create a seat. Steam-bent some reclaimed wood for the armrest, used a lathe to shape legs
- Motorized drift trike- Welded a frame using a jig, grinding steel tubing that was bent and notched
- Recycled plastic skateboard- Experimented with HDPE that I collected, cleaned and melted to prove commercial and physical viability of product



^Class project^



SILVER SMITHING AND BRANDED MATERIALS

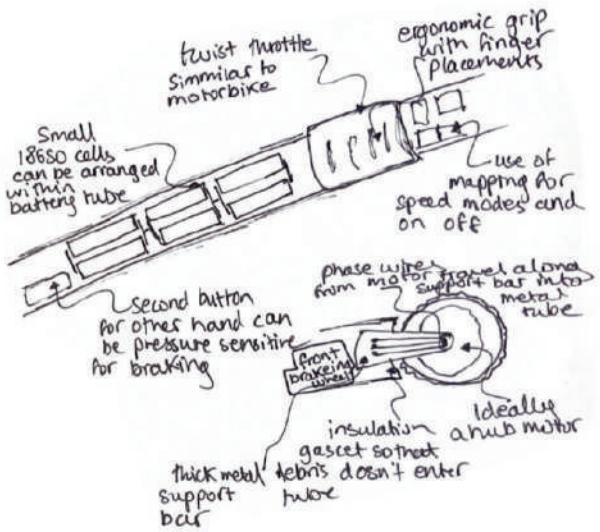


2017-2018

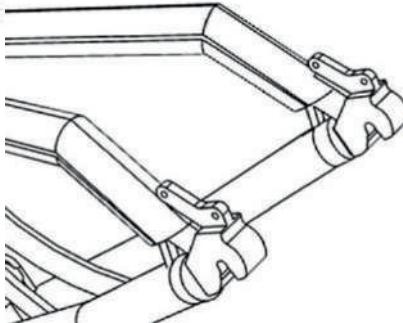
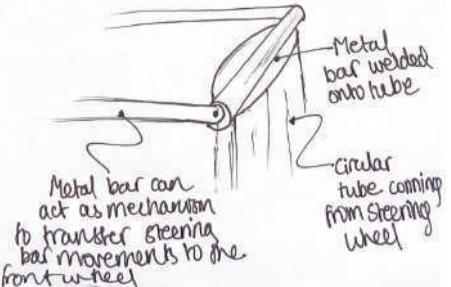
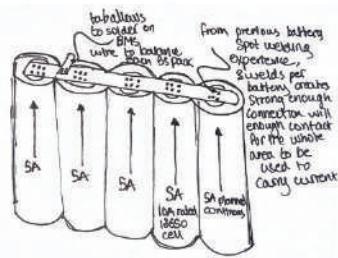
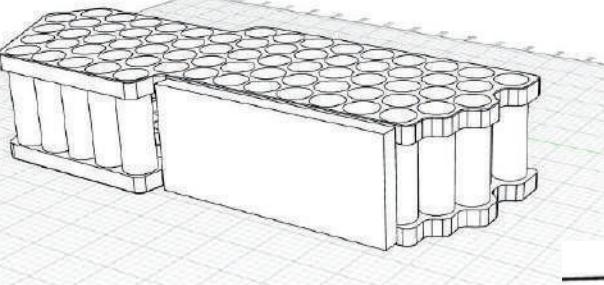
Various jewelry pieces made for my mother and sister, using hammered silver.
Inspired by French jewelry maker Jean Din Vahn.

Created various branded marketing materials for the company Anato, a zero waste skincare line.

Scrap wood keychains were made to thank donors for Plastic Tides, a U.S. based charity that I was ambassador for.



Final Battery Design



Prototyping section and manufacturing techniques



Split here

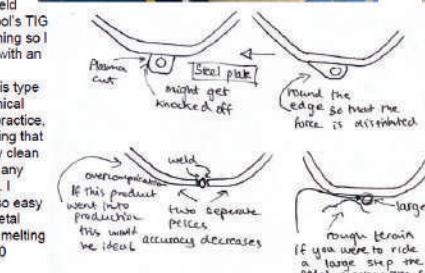
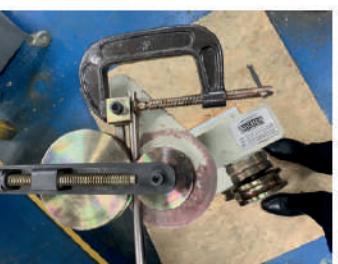
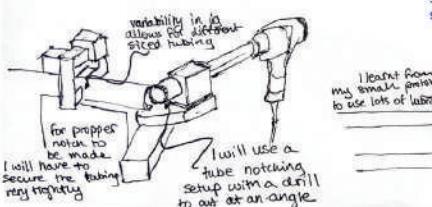
After choosing the bike design, I am going to experiment with metal techniques to make a frame. This is me testing bending in a tube bender with small diameter tubing. It was quite easy to bend but it would be hard to get an accurate bend per degrees.

This was a major learning point. The metal was bent around but then went beyond the critical point where it became stuck onto the mandrel. In my final design, the parts will have to be produced separately and then welded together.



Here I am trying TIG weld aluminium but my school's TIG welder was malfunctioning so I struggled. After a chat with an local engineer, it was explained to me that this type of welding is very technical and requires years of practice, especially with thin tubing that has to be kept in a very clean environment to not get any impurities on the metal. I understand that it is also easy to blow a hole in the metal considering aluminium melting point is only around 600 degrees.

This experience has resulted in me deciding not to use aluminium as a material for the frame. Steel seems like a suitable alternative for its high strength and fusibility.



I drew a marking jig on some cardboard as I tried to put together a low fidelity model. This process was much more difficult than I expected. The metal has some elasticity to it that made it difficult to figure out how far to bend the metal around a certain point. I found that marking the metal only helped so much as the metal bending machine had some play to it which produced some variability in terms of bending distance.

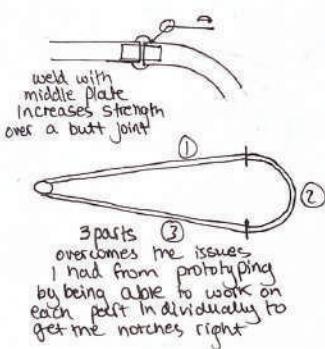
Creating a template to bend the metal was not accurate enough. I will thus need to produce a bending jig for each part to make sure they are all within tolerance according to the engineering drawings.



Producing the top part as one piece resulted in multiple challenges, including cutting holes at angles because it was difficult for the machine to grip the metal bar. Another reason to produce the parts separately and Weld together.



There was some variability here in terms of fixing the bar to a specific place. This is the smaller tube bender. On the full scale prototype I will use the larger metal bender that is more accurate and doesn't have this issue.



FINAL SCHOOL DESIGN PROJECT - ELECTRIC MOTORBIKE 2021

For my A-level design project, I designed and developed but didn't build an electric motorbike. Above are screenshots from my A-level design portfolio.