Design Portfolio

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About Me

uWaterloo Grad (14' - 19')
Mechanical Engineering

3 years of technical experience focused on **mechanical design, rapid prototyping, and validation testing**

Skills

Design
- Solid Modelling
- DFM & DFA
- Drafting (GD&T)
- DFMEA
- Rapid Prototyping

Hardware
- Raspberry Pi
- Arduino
- Phidget I/O
- Tensile Testing
- Digital Multimeter
- Dial Indicators
- Microscopic Imaging

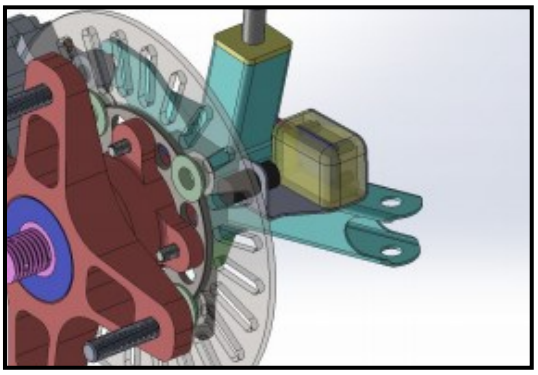
Testing
- Verification & Validation
- Root-Cause Analysis
- Product Calibration
- Automated Data Analysis and Collection
- IQ OQ PQ

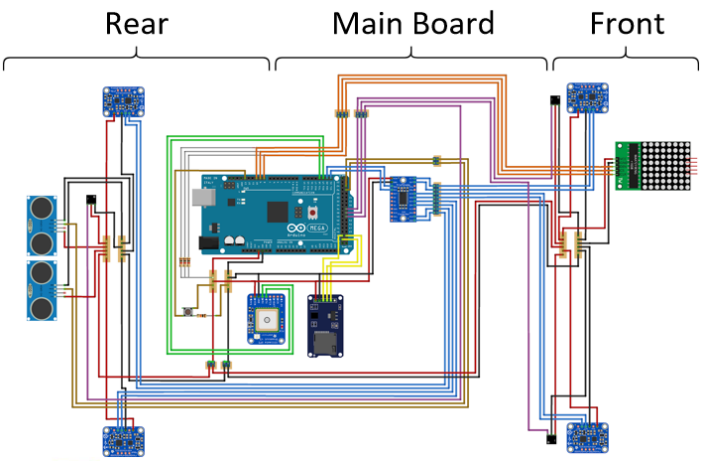
Fabrication
- 3D Printing (FDM, SLA)
- Manual Machining
- Soldering
- Ultrasonic Welding
- Laser Cutting
- Water Jetting
- Wood Working

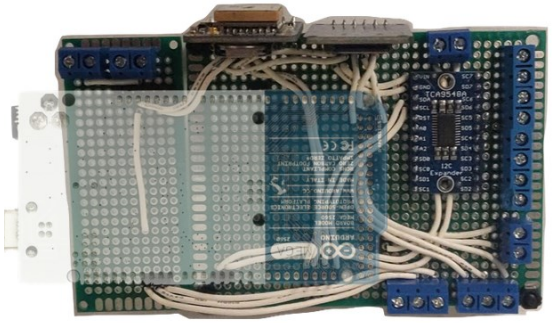
CAD Software
- SolidWorks
- NX
- CATIA V5
- AutoCAD
- ANSYS CFX

Software
- Python
- MATLAB
- VBA

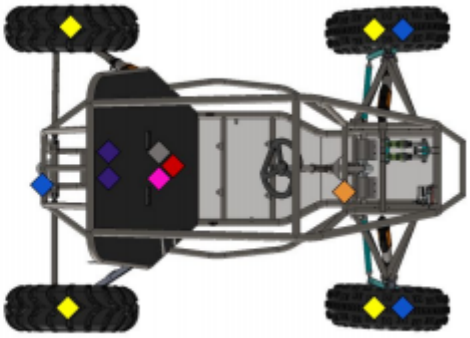
Miscellaneous
- Linux CLI
- MS Office
- Git





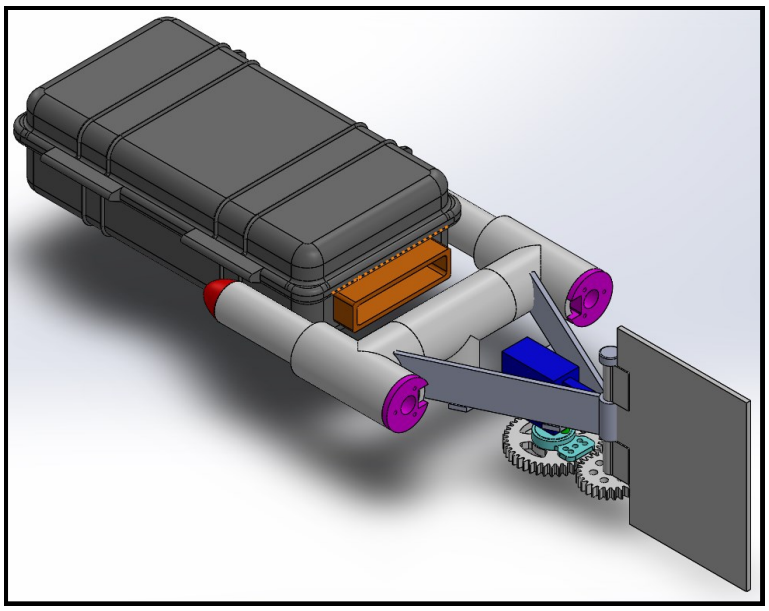


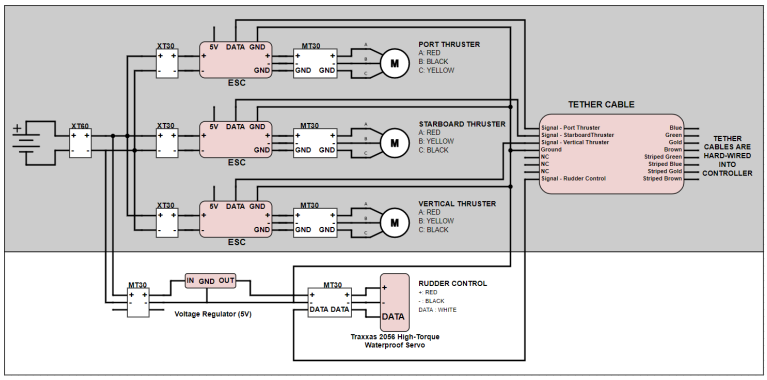
	Item	QTY	Purpose	
Main Board	Arduino Mega2560	1	Microprocessor	
	GPS Breakout	1	Global Position & Speed	
	SD Card Breakout	1	Data Collection	
Inputs & Outputs	Hall Effect Sensor	3	Wheel Speed	
	IMU Sensor	4	Acceleration	
	Ultrasonic Sensor	2	Fuel Level	
	8x8 LED Display	1	Fuel Gauge	

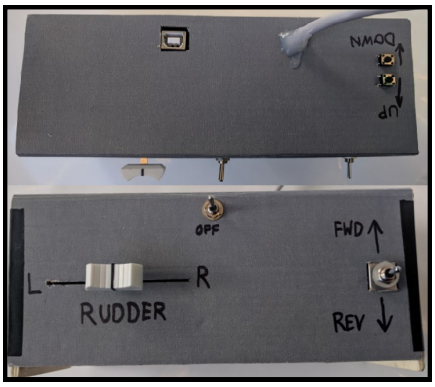


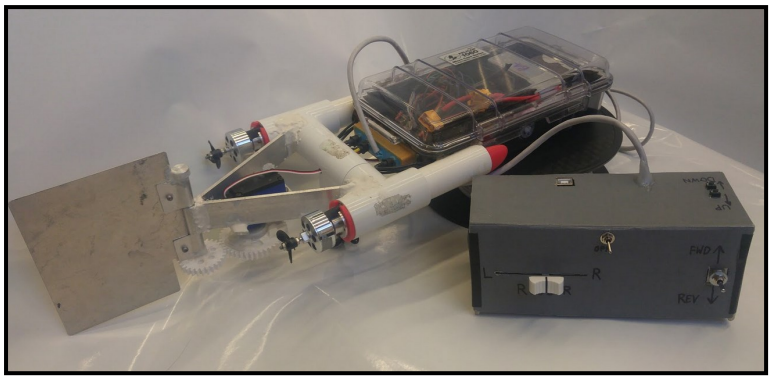
Baja SAE Vehicle Data Acquisition System

As a member of the UW Baja SAE student design team, I led the developed of an on-board vehicle data acquisition system for the 2019 race-car. The DAQ collects critical performance metrics during testing and competition, as well as providing real-time fuel information to the driver during endurance events. Build around an Arduino core and powered by an onboard battery, the system is a self-contained package with an assortment of ultrasonic, hall effect, IMU, and GPS sensors around the vehicle that can be easily disassembled.







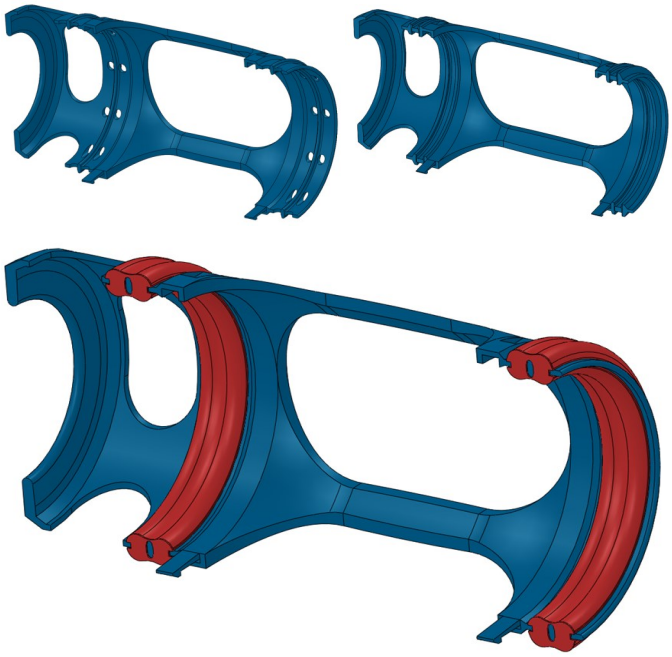


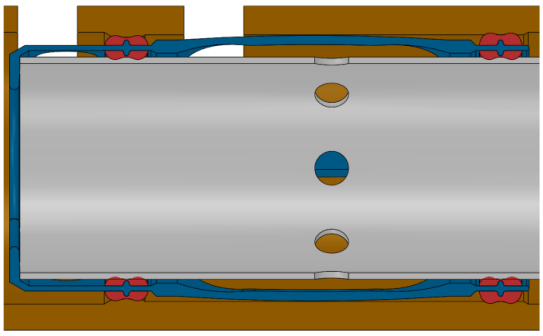
My Role

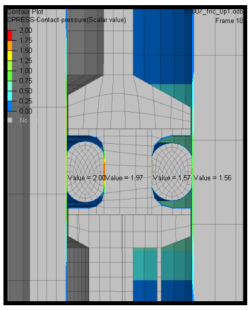
- Design and fabrication of the physical controller and electrical wiring
- Programmed system functionality in C++
- Assisted with fabrication and assembly of 3D printed parts

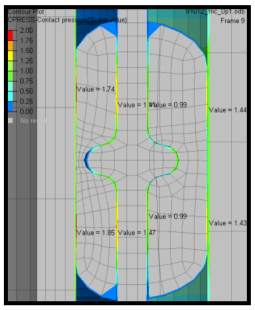
Remote Operated Submarine

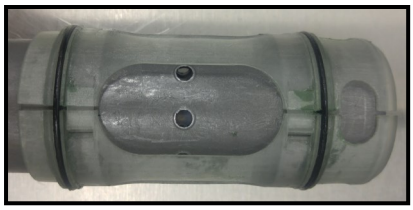
The ROV is an Arduino powered submarine that is remotely operated through a tethered controller. Two forward mounted brushless DC motor and ESC units control propulsion, while a third mounted vertically controls pitch. A rudder system attached to a 3D printed gearset (2:3 gear ratio) and waterproof stepper motor allows for yaw motion while maintaining full forward thrust. The submarine is constructed of 1 inch diameter PVC piping and 6061-T6 aluminum, and is controlled by a simplistic ergonomic controller.

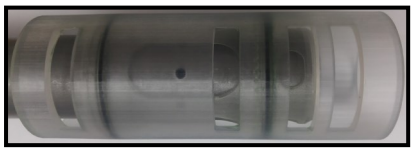


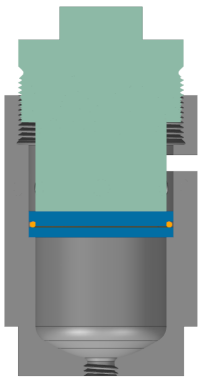










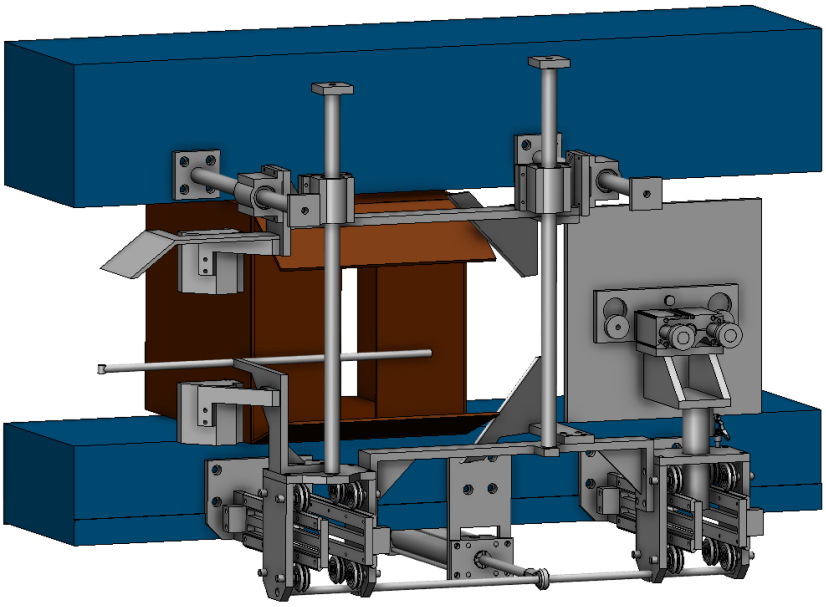


Design Stages

- Conceptual design and generation of design specifications
- Functional testing of various O-Ring and cavity shape/size configurations
- Iterations of detailed CAD design
- Design reviews to assess DFM and DFA
- FEA analysis to examine both assembly and high-pressure functionality
- 3D printed prototypes to validate fit tolerances and assembly procedure
- Discussion with external high-volume manufacturers

Cavity Sealing Bracket Assembly

The cavity sealing bracket is a sub-assembly within the damper body that acts as a sealing mechanism between the high-pressure fluid cavities. Two zinc die-casted half-circles form the frame that holds the mechanical gasket in place, and both standard circular O-rings and a custom over-molded gasket were investigated for their sealing ability. The new mechanism simplifies the assembly process and reduces chance of gasket damage during installation.

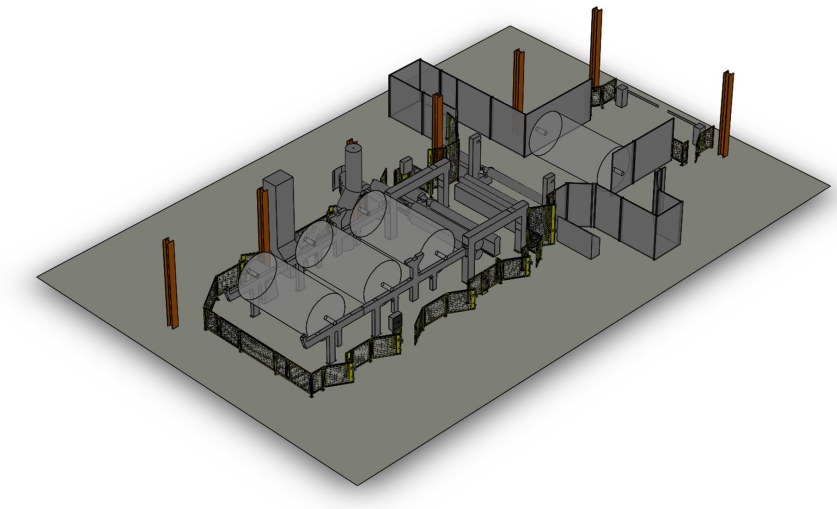


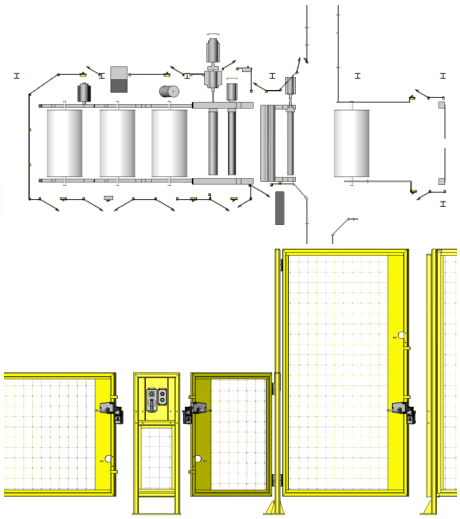
Key Features

- Eliminates key bottleneck on production line, which previously required box to fully stop
- Paper-grade change downtime reduced from 1 hour to 10 minutes with easily swappable parts
- Paper-grade changing is pneumatically powered, reducing operator involvement

Kleenex Tissue Case Packaging Machine

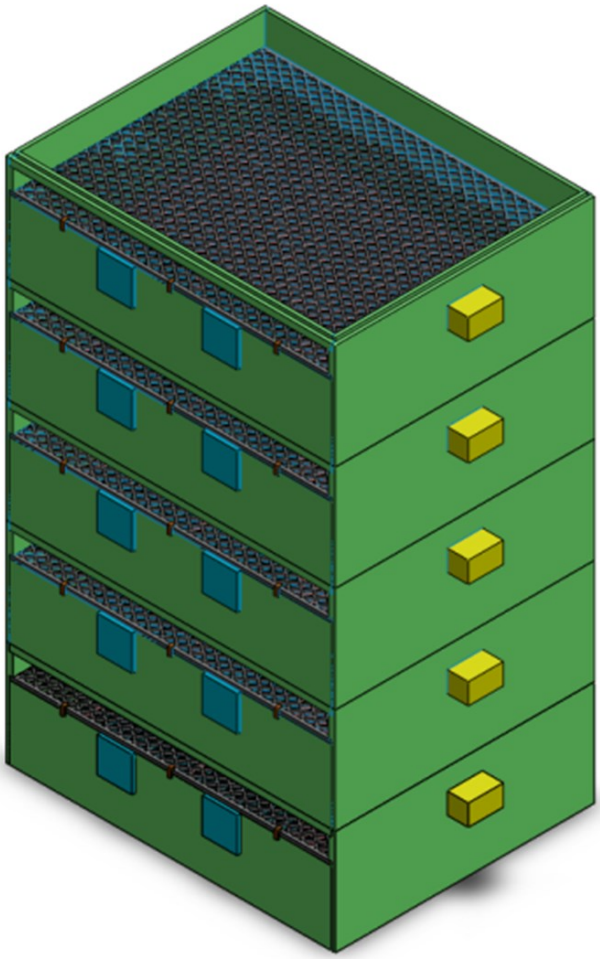
The pneumatically powered packaging machine is a key feature of the tissue production line that prepares the product for shipping. As the case of individual Kleenex box moves along the conveyer, extending rods move the inner flaps into position and glue applicators spray the surface with glue. The outer flaps are then closed inwards and sealed with an actuation of the push plate.





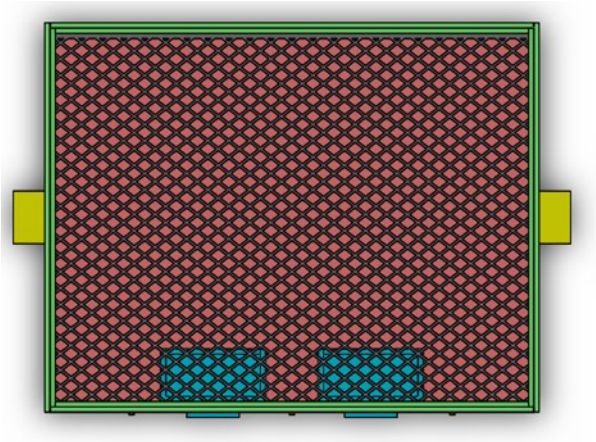
Tissue Re-winder Safety Guarding

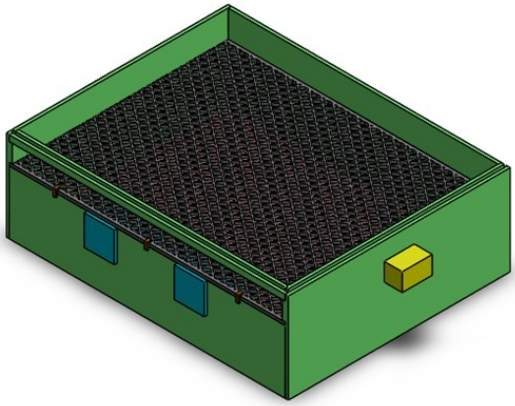
Designed and installed a safety guarding system around the tissue rewinder system. Interlocked guarding prevents operator injury while still maintaining functionality through operator control panels. Framing can be easily removed for maintenance, and operators still have access to machinery in critical locations after following SOP to lock-out. Produced set of technical drawings and worked closely with local contractor to fabricate, weld, and paint guarding.



My Role

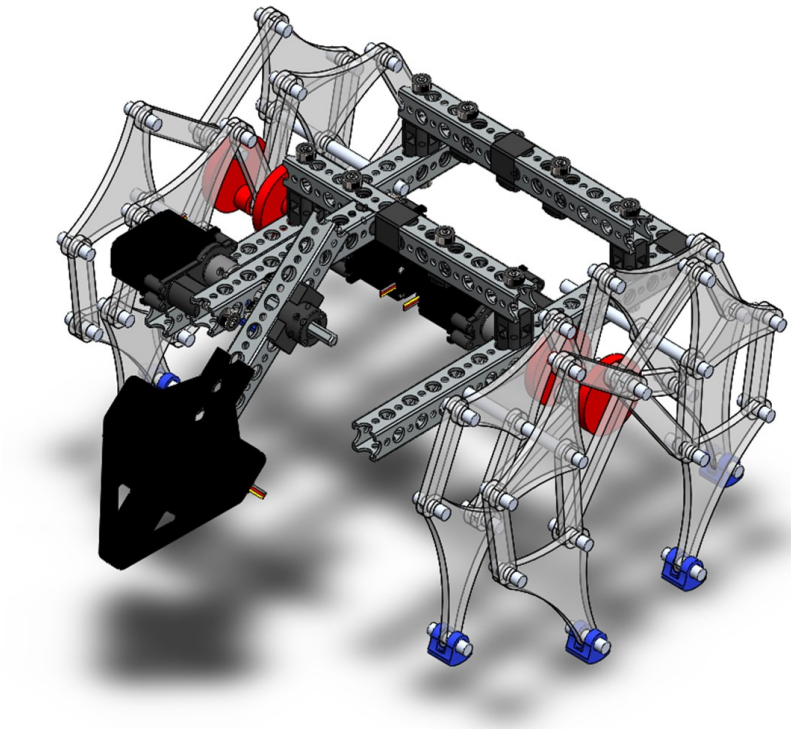
- Investigate methods of cricket farming and consumption, and produce preliminary specifications
- Design prototype of stackable cricket enclosure
- Build and test prototype with live crickets
- **Eat cricket brownies**

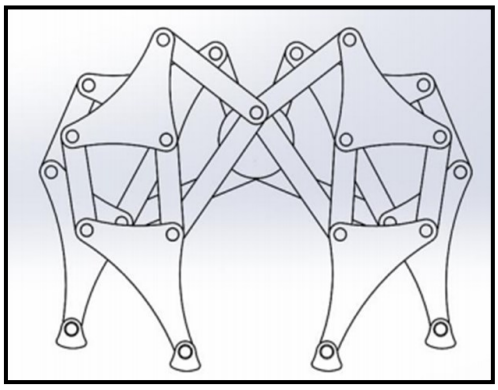


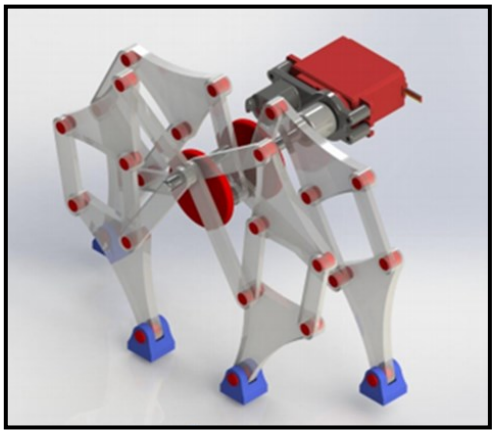


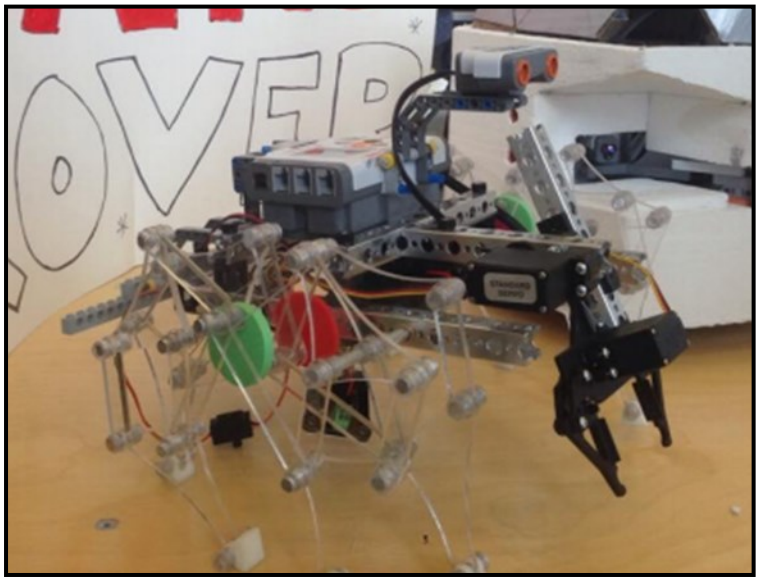
Project Cricket Prototype Enclosure

Project Cricket was a sub-team of Enactus Waterloo that investigated cricket farming as an eco-friendly alternative to traditional livestock farming processes. Benefits includes low space and resource requirements, little human involvement, high nutritional and protein value, scalability, and applications in third-world countries with extreme climate conditions. The objective was to raise awareness for entomophagy while working with independent companies to develop potential farming solutions.









My Role

- Fabricate linkage members and gears using FDM 3D printing and laser cutting of 3/8" acrylic
- Programming the rover's functionality in C++

Mars Spider Rover

The Spider Rover is a Lego NX powered robot that is inspired by Jensen's Linkage, a planer leg mechanism which generates a smooth walking movement through the conversion of rotational to linear motion. This allows it to move through rough terrain, as well as avoid obstacles through the use of a touch and sonar sensor. A single servo motors powers each side of the spider, and a third motor powers the front gripper to move objects. The system is remotely controlled by a Logitech controller through a custom C++ library.