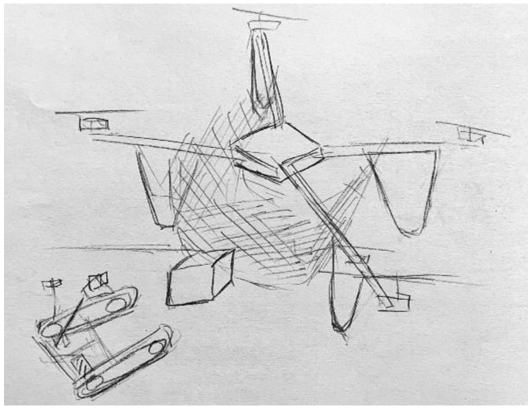
Rhino - Unmanned Ground Vehicle

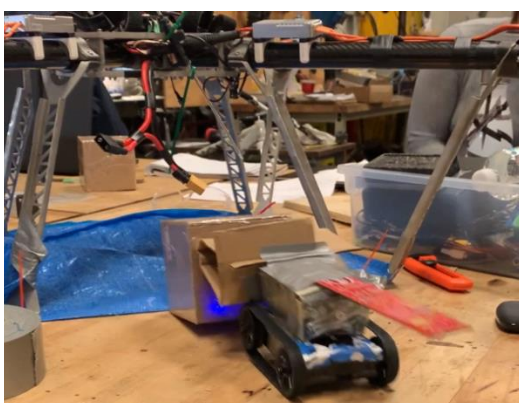
UBC UNMANNED AIRCRAFT SYSTEMS

Designed and developed from scratch in a sub-team of 5 for the 2020 Unmanned Systems Canada Competition
Mission: To identify and retrieve medical supplies onto the drone for unmanned delivery



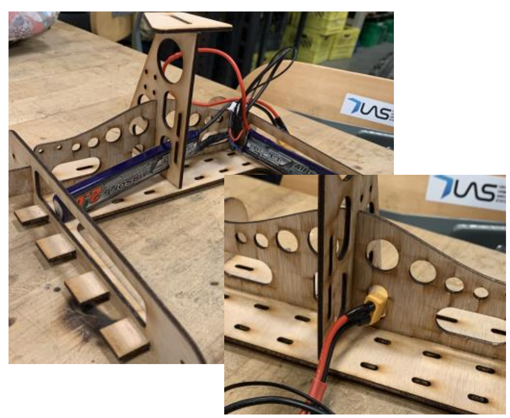
Payload Deployment System

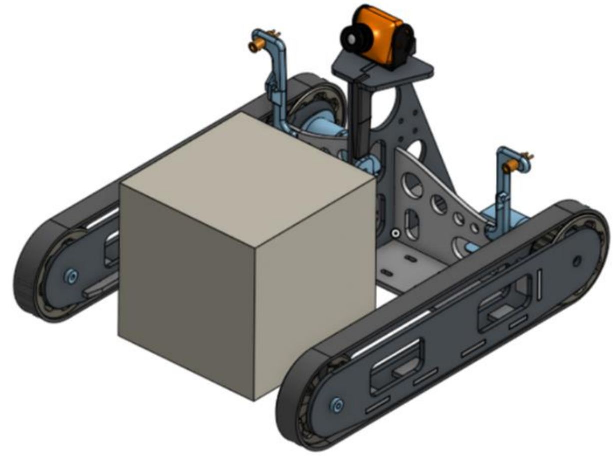
I **conceptualized** the “net” - a simple, secure, and lightweight method of deployment and retrieval. I **led** my sub-team to test the concept with a toy tank.



Detailed Design and Rapid Prototyping

I **designed** the chassis on OnShape with electronics integration in mind. I **manufactured** using 3D printing and laser cutting. The batteries, XT60 connectors and wires fit perfectly through the holes.

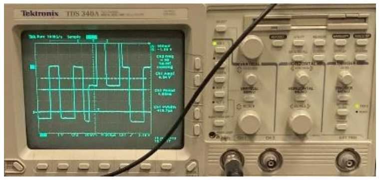




Design Feasibility Modeling

I **modeled** torque and energy draw on Excel to determine the feasibility of motors and batteries for the mission requirements. The results helped inform which motors and batteries to purchase.

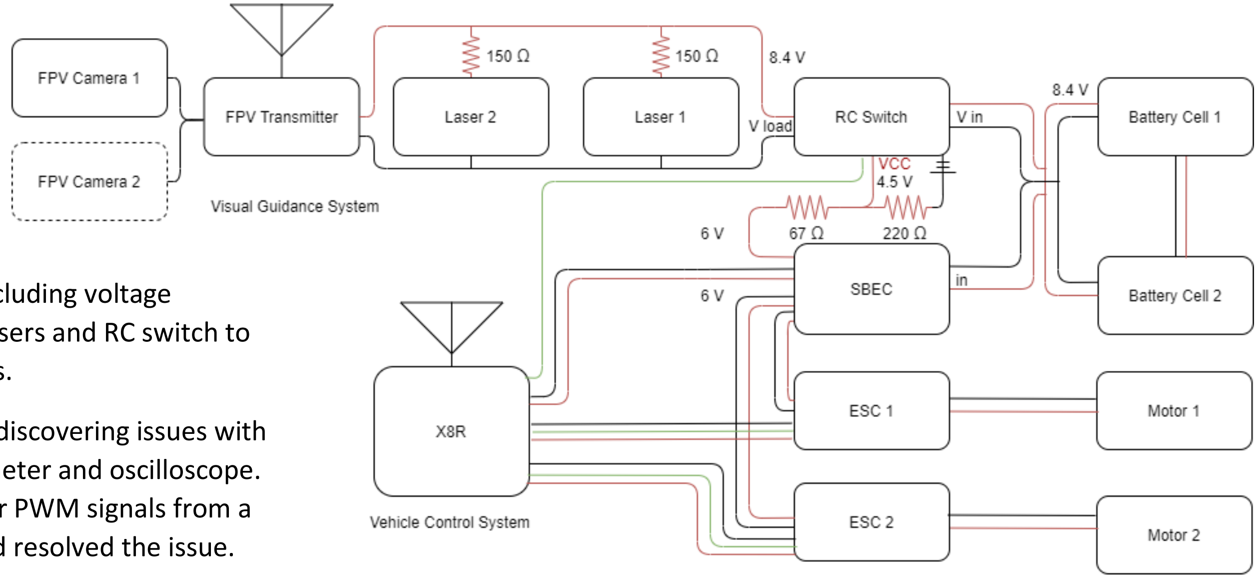
Per Run		**Range (m) (runs*d per run)**
Total current draw (Ahr)	0.0273824145	Total displacement (m)
Battery capacity (Ahr)	2	
		Range Without Box (m)
Possible Runs	**15.66651042**	Motor speed (rpm)
Distance travelled per run	25	Rover speed (m/s)
Estimated time per run (s)	116.5536805	
		Range With Box (m)
		Motor speed (rpm)

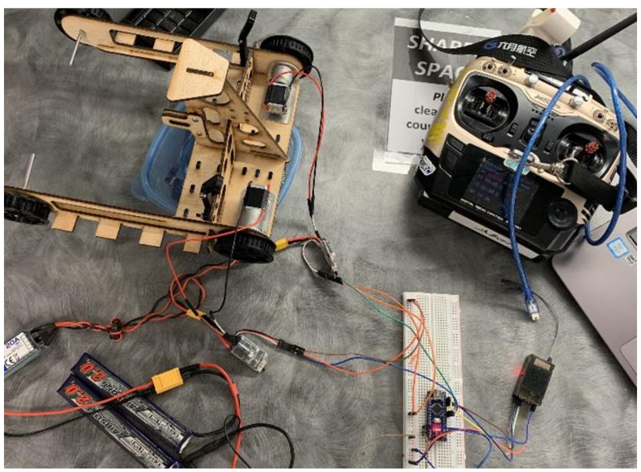


Electrical Design and Testing

I **designed** 40% of the electrical circuit, including voltage dividers to decrease the voltage for the lasers and RC switch to not exceed their maximum voltage ratings.

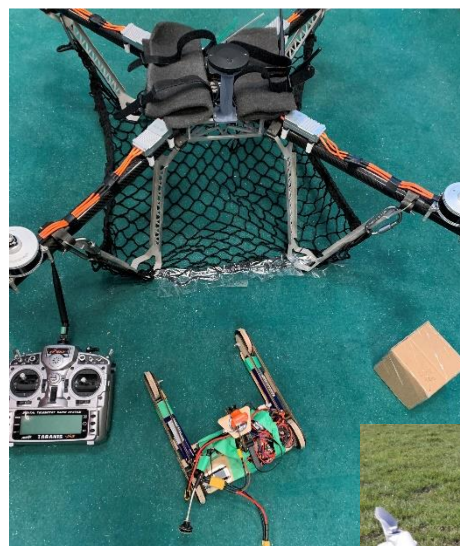
I **tested** the entire electrical circuit. After discovering issues with the signal, I **investigated** using the multimeter and oscilloscope. The problem was associated with irregular PWM signals from a faulty receiver; I replaced the receiver and resolved the issue.





Remote Control Programming with Microcontroller

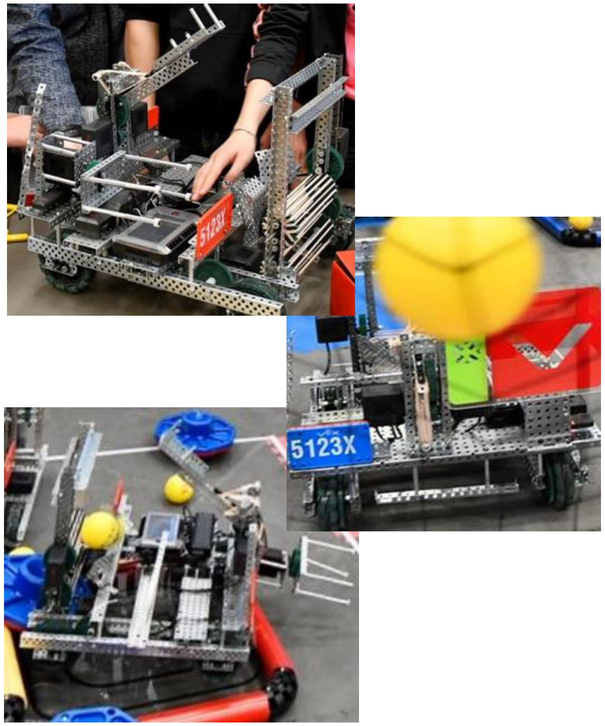
I **programmed** the RC control on an Arduino Nano to map the 3 PWM input channels from the receiver to the 2 PWM output channels to the motor controllers. This enabled full bidirectional control with pivot and differential steering.



System Integration and Mission Testing

VEX Robotics

I was involved in my high school extracurricular club from 2014 to 2019. The provincial competitions involved 4 robots on a playing field competing autonomously and driver-controlled for different objectives each year.



2019 Turning Point Competition

Designed and built in a team of 2. I did 100% of the design, 90% of the build and electronics, and 50% of the programming.

Scoring objectives: launch balls to hit targets up to 1m high, flip plates, and park on raised platforms before other robots when the match ends.

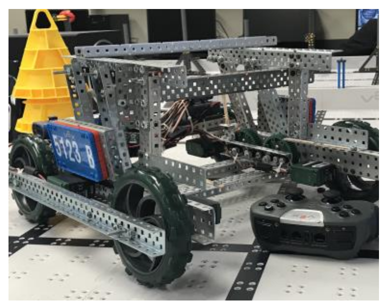
Functions include 4-wheel drive with skid-steer control, ball intake system, catapult, deployable plate flipper, and a “hold” button that allows the driver to lock all 4 wheels to prevent it from getting pushed by other robots.

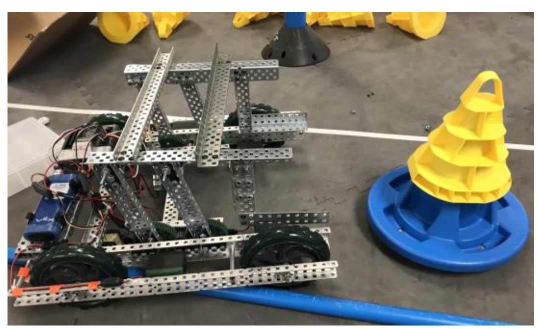
2018 In the Zone Competition

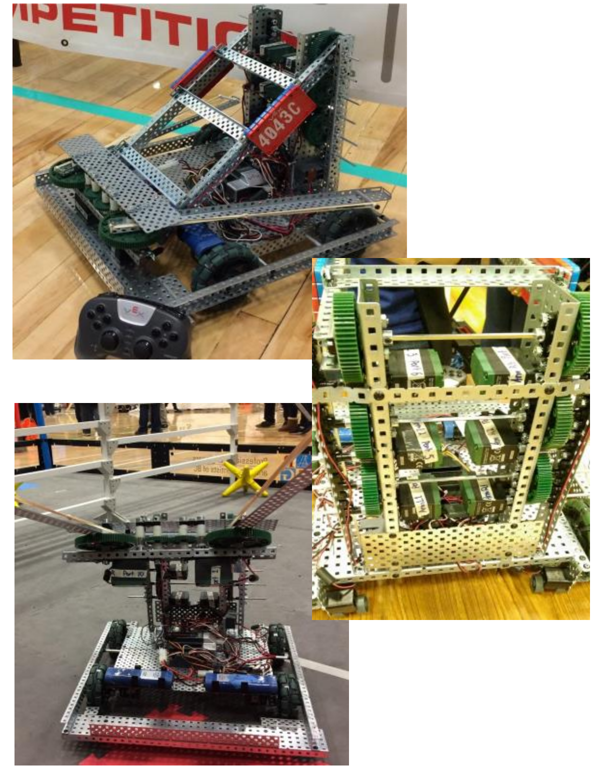
Designed and built in a team of 3. I did 100% of the design, 75% of the build and electronics, and 100% of the programming.

Scoring objective: lift large cones (base diameter of 25cm, mass up to 2kg) over horizontal obstacles up to 60mm high and deposit them into scoring zones.

Received the ***Judge’s Award at the 2018 VEX Pacific-Northwest Championships*** for autonomous scoring.







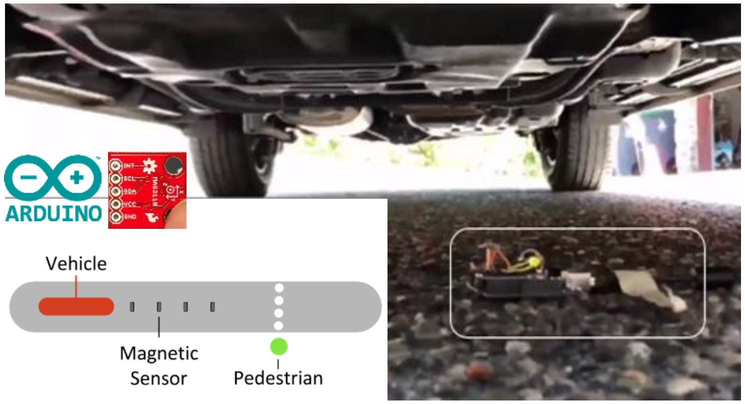
2017 Starstruck Competition

Designed and built in a team of 4. I did 100% of the design, 70% of the build and electronics, 50% of the programming.

Scoring objective: pick up and toss large cubes and stars (diameter of 32cm, mass up to 1kg) over a 61cm high fence.

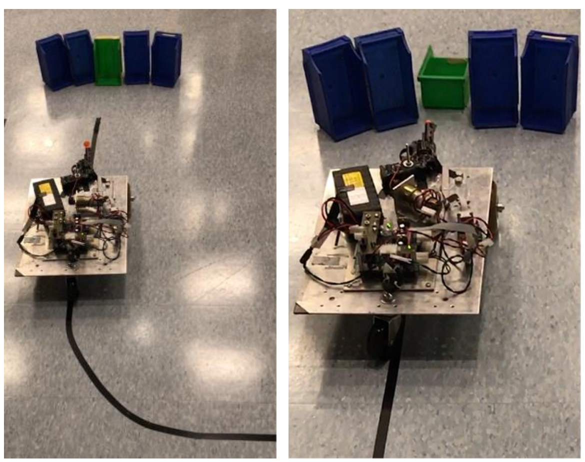
Robot picks up and tosses large cubes (mass up to 1kg) over a fence 1.5 times its compacted height and blocks opponents from scoring.

Other Select Projects



Vehicle Detection with Magnetometer for Pedestrian Safety

I **built and programmed** a device to detect vehicles' presence with a magnetometer and warn pedestrians by lighting an LED. I **tested** in the parking lot with moving vehicles and **designed** a system of multiple devices to indicate vehicle proximity.



Line-Following and Toy Gun Firing Robot

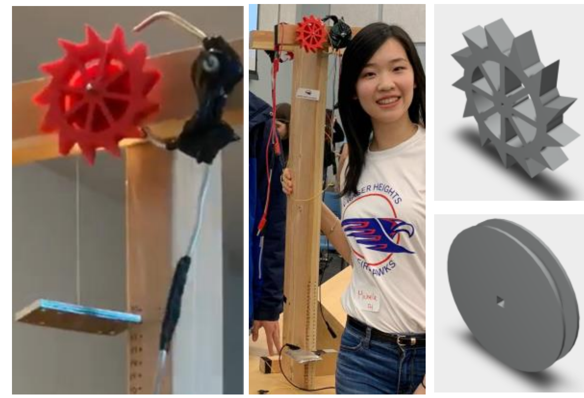
Developed in a team of 4. I did 100% of the programming, 50% of the mechanical and electrical assembly.

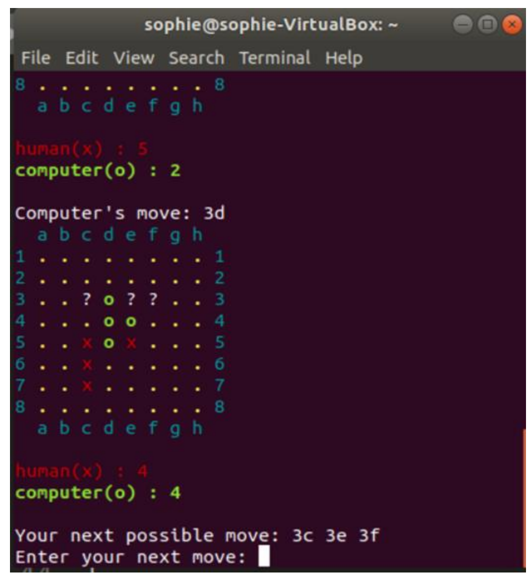
I **programmed** the line tracking code that uses the input from the photoelectric sensor to coordinate the motors and trigger a toy gun to fire at the end of the path. The robot follows the path from beginning to end and hits the middle target with 87% accuracy. Qualified for ***semi-finals in the SHAD Robotics Competition*** out of 80 competitors.

Mechanical Timepiece for UBC Physics Olympics

I **designed and built** this device in a team of 5 to mechanically keep time using the escapement gear concept. I did 85% of the mechanical and electrical switch design.

It is programmable to close one electrical switch between 10-30 seconds and another between 60-90 seconds with an accuracy of ±0.2 seconds. It ranked ***7th out of 73 teams*** at the 2019 UBC Physics Olympics.





Reversi Game in C++

I **programmed** a reversi game played by a human against the computer using object-oriented programming. Key features include:

A "board" class to manipulate game pieces according to the rules

"Player" classes that inherit from the board class

Game strategies for the computer to increase the level of difficulty of the game