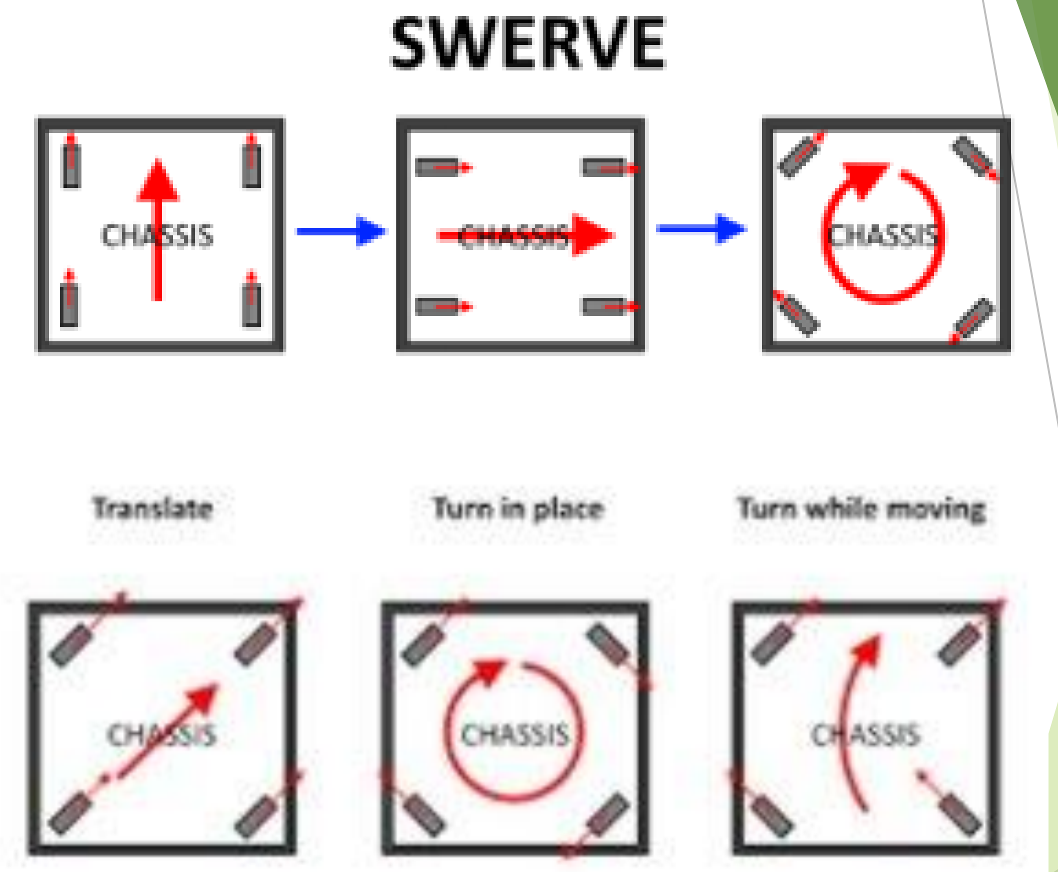
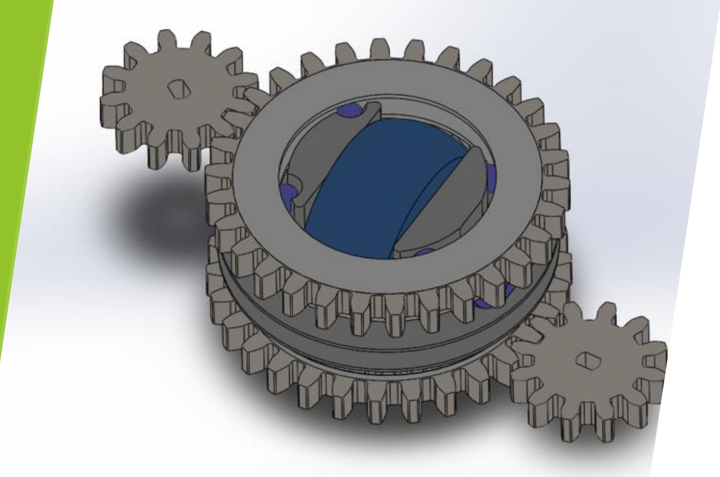
Swerve Drivetrain

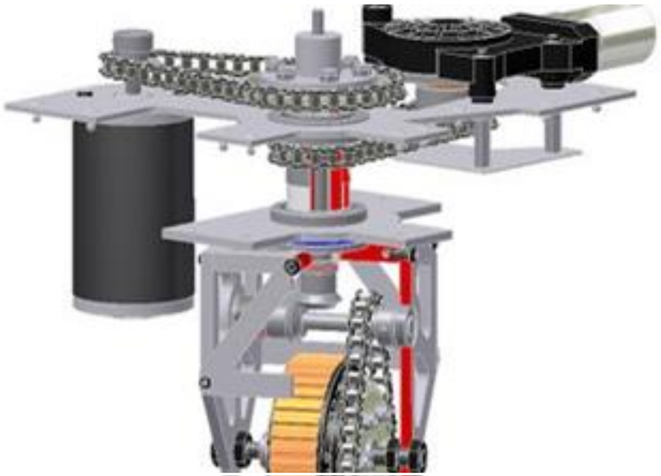
737-A

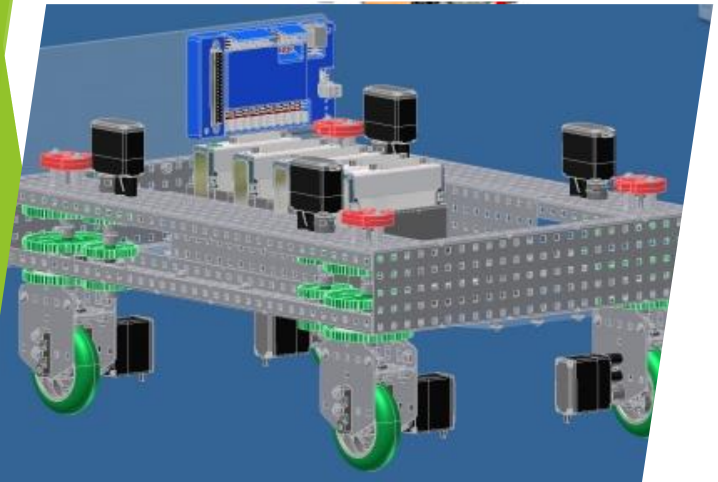
What is a Swerve Drivetrain?

- Able to strafe in all directions
- Able to rotate wheels in the direction of movement









Design Ideas

- Differential Swerve
- Transmission Swerve
- Direct Drive

Considerations When Choosing a Design

-Financial cost per design

-Reusing parts from old robots

-Attachment for use in further projects

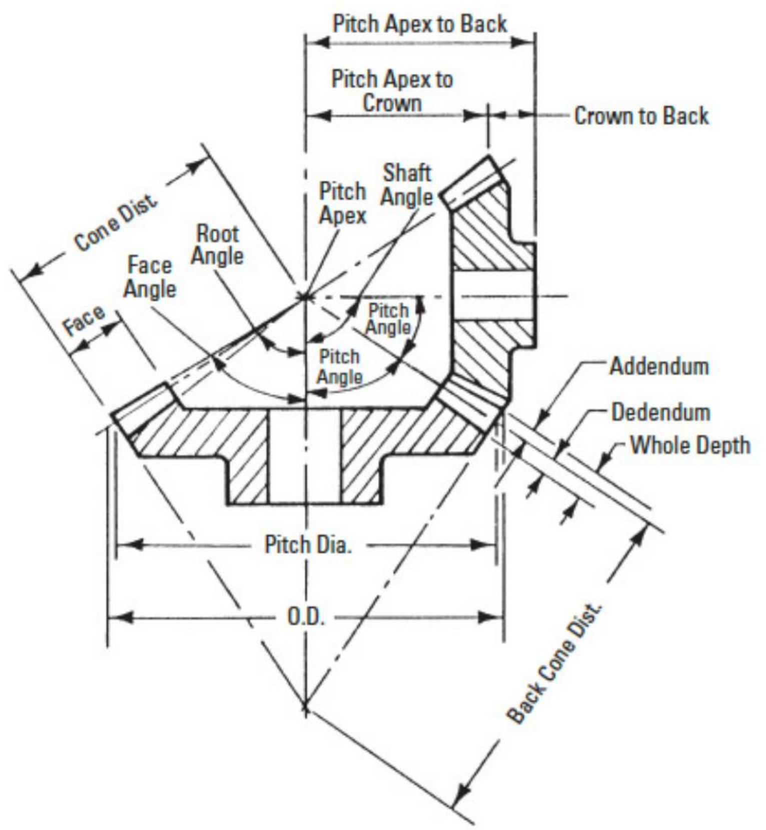
Completing the Design

Many smaller decisions needed to be made

- Gear supports
- Power transmission

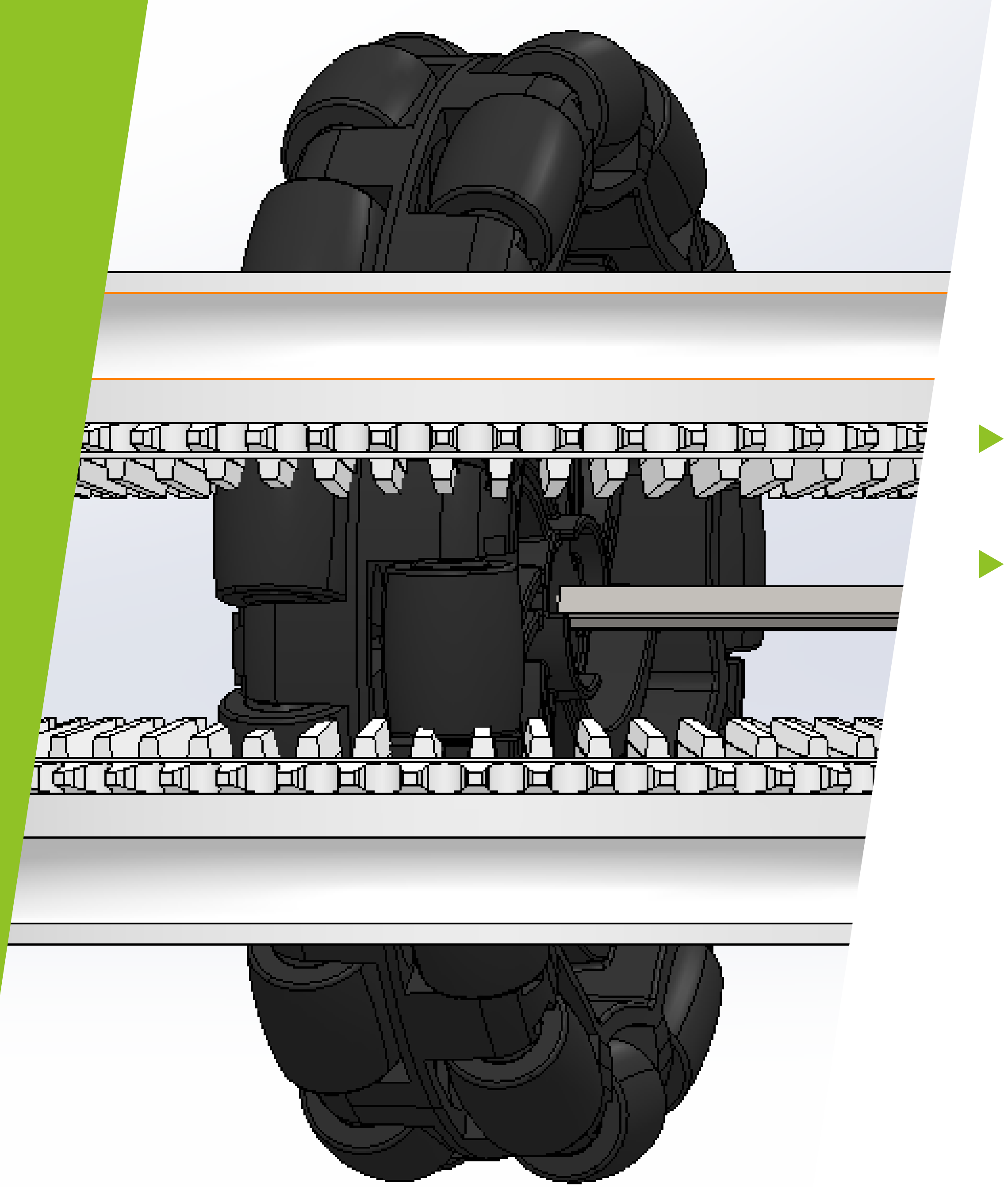
Needed a plan to acquire VEX-legal parts

- Only able to use radial bearings



Preliminary Design Calculations

- Key system of the design were the custom-built gears
  - They are the base that everything builds off
- Calculations are all connected
  - Everything starts by picking an inner diameter and a gear ratio
  - Everything else, including teeth angles, pinion gear size, and tooth depth is calculated using set equations

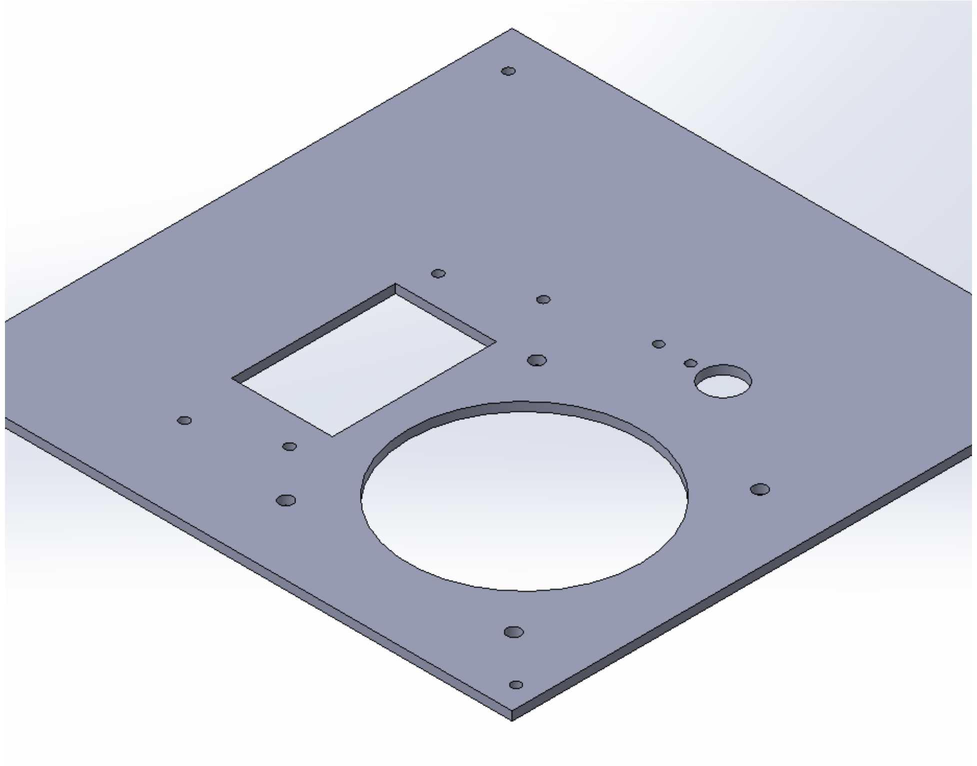


Key Design Parameters

- Needed to fit the 4-inch wheels inside the gears
- Targeting a 4:1 gear ratio from our research

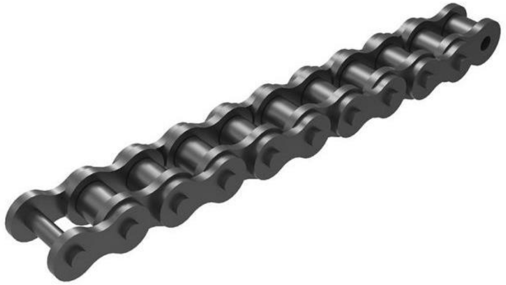
Designing

- Gears were then designed in SolidWorks and modelled using an assembly to ensure proper alignment
- Mounting plates and motor mounts were also assembled separately using the spacing determined by the calculations



Challenges

- Incompatible parts
  - CAD files required to be completed before the parts list was created
- 4" omnidirectional wheel does not have a 4" diameter
- QVEX team could only provide Vex high-strength chains



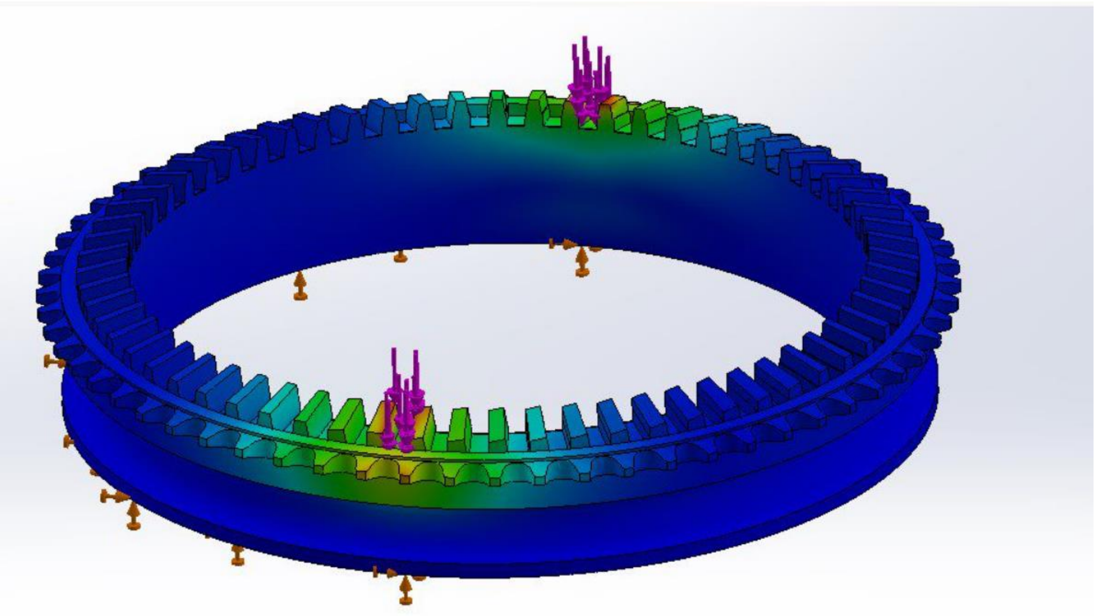
Solutions

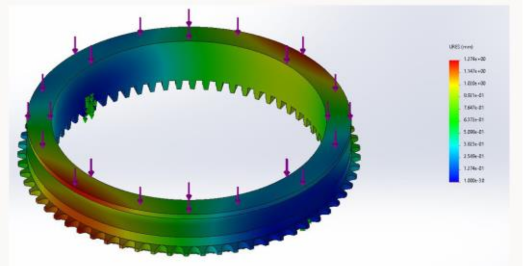
- Swapped omnidirectional wheel for a standard Vex wheel
- Chains were replaced with gears
- CAD file for compatible gears was found and 3D printed
- Mounting plate was altered to accommodate for the loss of chains

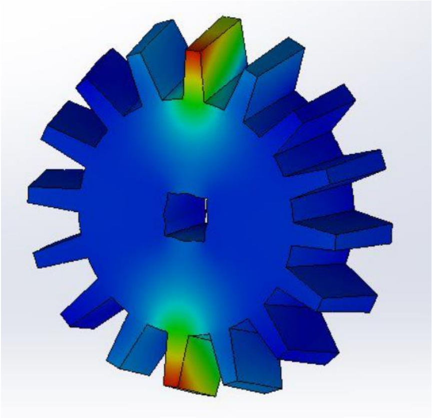
Building

- Began by machining the mounting plates with the altered hole placements
- Sharp edges were sanded and covered in electrical tape
- Mounting plates are thin and warped under the force of machining
- The gear teeth interfere with the bearing shafts

Testing







- Testing was done through various simulations in SolidWorks
- Diagrams represent the load distribution of a 270N weight (weight of a robot)

Testing: Motion Study

Using the gear ratio of 18:64, the model achieved a constant velocity of 3.59 $\frac{m}{s}$

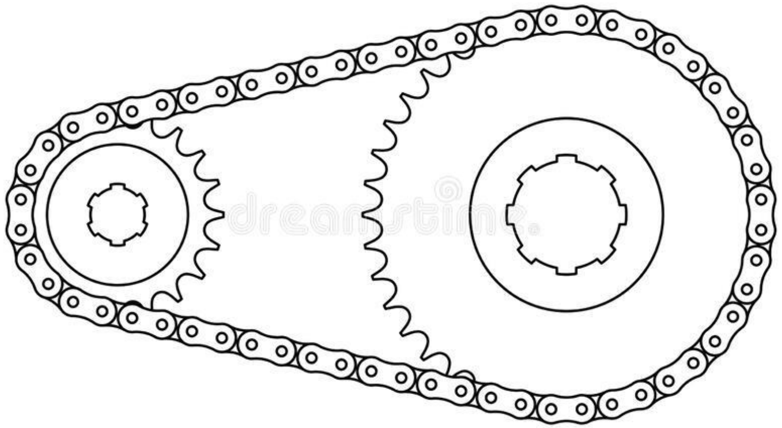
Driving

Rotating

Analysis of Results

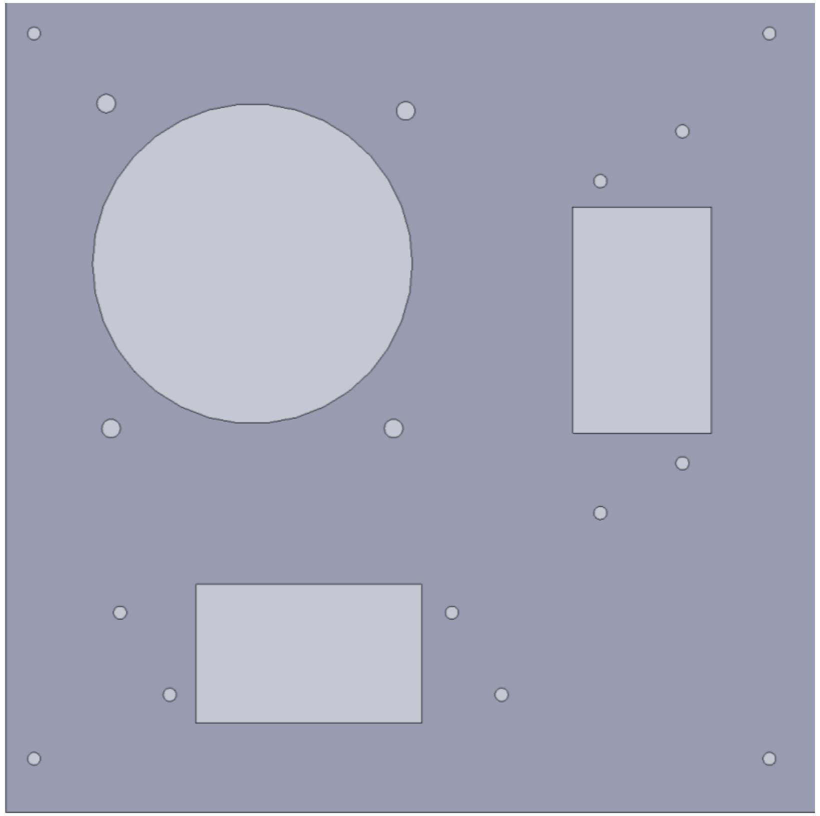
Goals

1. Velocity of 5 m/s
2. Improved strength
3. Decrease in size



Recommendations

1. Use chains to allow flexibility within gear ratios
2. Properly machine mounting plates from thicker metal to provide a stronger base
3. Position motors closer together



Implementation

- Using a larger metal sheet, template will be cut four times in each corner
- Metal pieces will be welded together
- Smaller bearing axles
- Bolts used to attach mounting plate to main chassis

Questions?