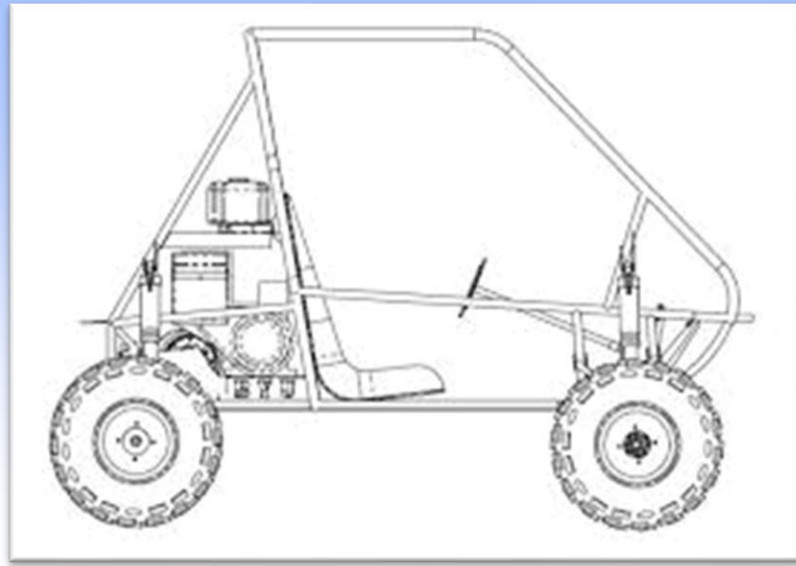




SUNY Canton Electric Baja Buggy Drivetrain



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What is a Drivetrain?

A drivetrain transmits power from either a motor or engine to the wheels to provide the required rotational motion or movement.

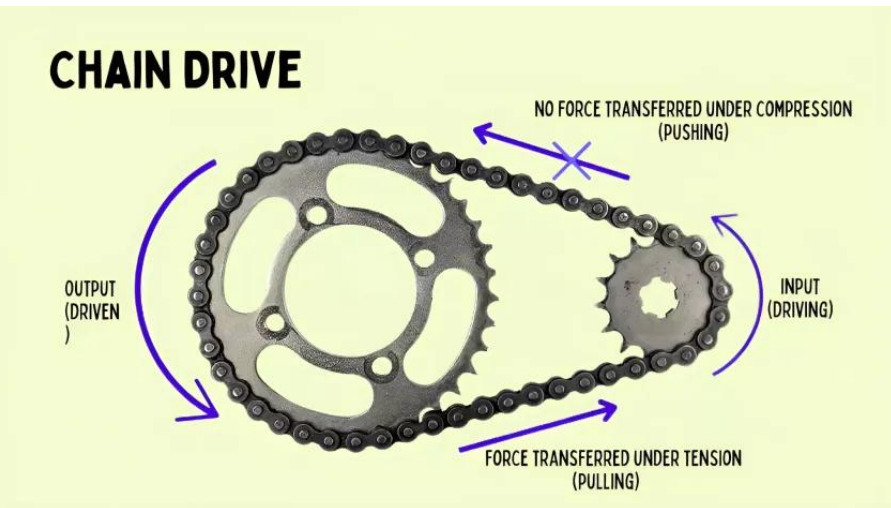


Figure 1: Chain Drive

A chain drive is a mechanical system that transmits power from one place to another using a chain and sprockets.



Figure 2: Planetary Gearbox

A planetary gearbox is a compact gear system that uses a central sun gear, planet gears and ring gear which transmits power.



Figure 3: Spur Gear box

A spur gearbox is a mechanical system that uses spur gears to transmit power and motion between two parallel shafts.

Engineering Specifications:

- Reach top speed of 40 mph
- Acceleration of at least 4 m/s²
- Minimize Friction in the Gearbox
- Design Components for 26 hp
- Minimize gear box weight
- Minimize heat inside gearbox
- Effective torque output (h = 94%)
- Maintain Center of gravity (Center and middle)
- Minimize size of gearbox and spacing

Capstone Objective:

- Make a working 3D printed gearbox
- Uses parts that can be bought online
- Make a design report explaining what we have learned for future students

Drivetrain Decision

Weighted Objective Table evaluated different differential and gearbox options based on key performance criteria and their relative importance. Each option was scored and weighted according to how well it met critical needs such as cost, size, weight, and acceleration. The Audi Torsion Differential was selected due to its highest weighted score and lack of negative trade-offs. Similarly, the Spur Gearbox was chosen for its superior performance in acceleration and cost—two of the most important criteria—resulting in the highest overall score. These selections provide a strong foundation for an efficient and reliable drivetrain design.

Drivetrain Design Decision				
Criteria	Importance	Spur Gearbox	Chain and Sprocket	Planetary Gearbox
Reach top speed of 40mph	4.16	0	0	0
Acceleration of at least 4m/s ²	5.05	1	-1	1
Maintain Center of gravity (Center and middle)	2.94	0	1	1
Minimize Cost	6.00	1	1	0
Minimum Friction Loss	2.11	1	-1	0
Minimize Weight	1.77	-1	1	0
	Weighted Total:	11.39	3.55	7.99
	Unweighted Total:	2	1	2
	# of Positive scores	3	3	2
	# of negative scores	1	2	0

Table 1

Differential Options

*All images are ½ scale

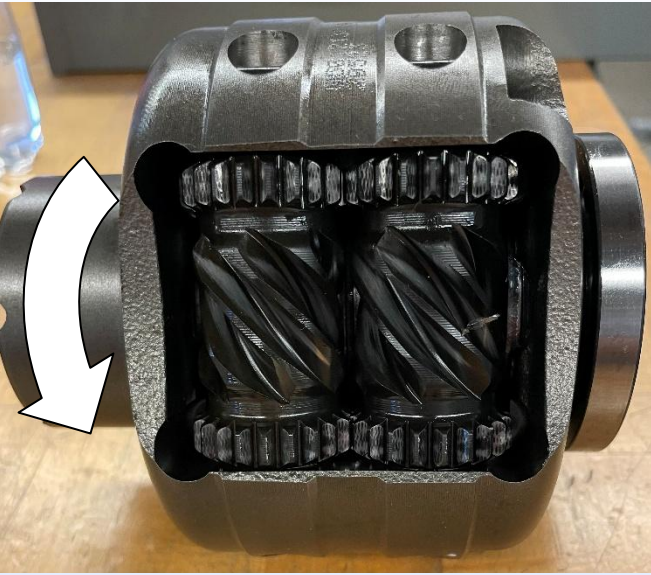


Figure 4: Audi Diff

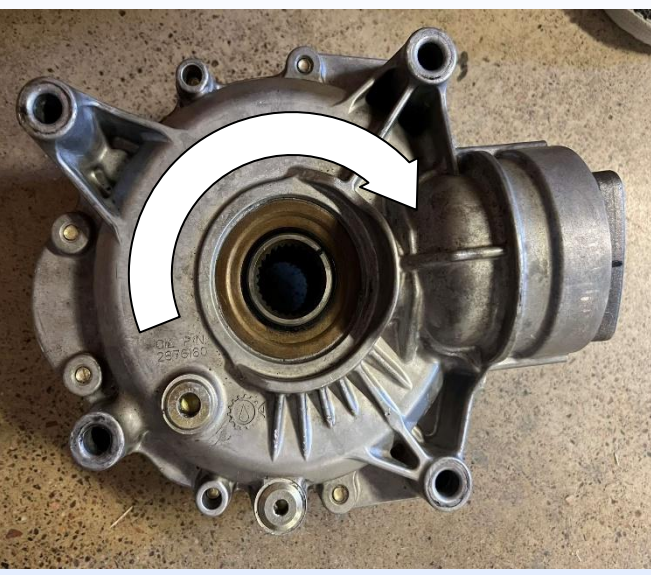


Figure 5: Polaris Diff



Figure 6: Chain Diff

Mph	Speed (ft/min)	Wheel	Gear ratio	Torque from motor (N*m)	Force (N)	Acceleration (m/s ²)
34	2992	591.5	6.8	248.1	1012.7	4.05
35	3080	608.9	6.6	241.0	983.7	3.93
36	3168	626.3	6.4	234.3	956.4	3.83
37	3256	643.7	6.3	228.0	930.6	3.72
38	3344	661.1	6.1	222.0	906.1	3.62
39	3432	678.5	5.9	216.3	882.8	3.53
40	3520	695.9	5.8	210.9	860.8	3.44
41	3608	713.3	5.7	205.7	839.8	3.36
42	3696	730.7	5.5	200.8	819.8	3.28
43	3784	748.1	5.4	196.2	800.7	3.20
44	3872	765.5	5.3	191.7	782.5	3.13
45	3960	782.9	5.1	187.5	765.1	3.06

Table 2 & 3

Pinion 1	Length of Shaft	Tangential Force	Radial Force	X - plane	Y - plane	Max Moment
	1	456	165.97	456	165.97	485.27
Gear 1	Length of Shaft	Tangential Force	Radial Force	X - plane	Y - plane	Max Moment
	3.7575	456.000057	165.97	1713.420214	623.63	1823.38
Pinion 2	Length of Shaft	Tangential Force	Radial Force	X - plane	Y - plane	Max Moment
	3.7575	912.000114	331.94	3426.840428	1247.27	3646.77
Pinion 3	Length of Shaft	Tangential Force	Radial Force	X - plane	Y - plane	Max Moment
	3.7575	912.000114	331.94	3426.840428	1247.27	3646.77
Gear 2	Length of Shaft	Tangential Force	Radial Force	X - plane	Y - plane	Max Moment
	5	912.000114	331.94	4560.00057	1659.70	4852.65

Table 2 and 3 show us calculated data for theoretical max speed and gear ratio and the max forces on the gears. (All the data is at what the maximum capacity of the motor with a safety factor of 1.2)

Gearbox Iterations

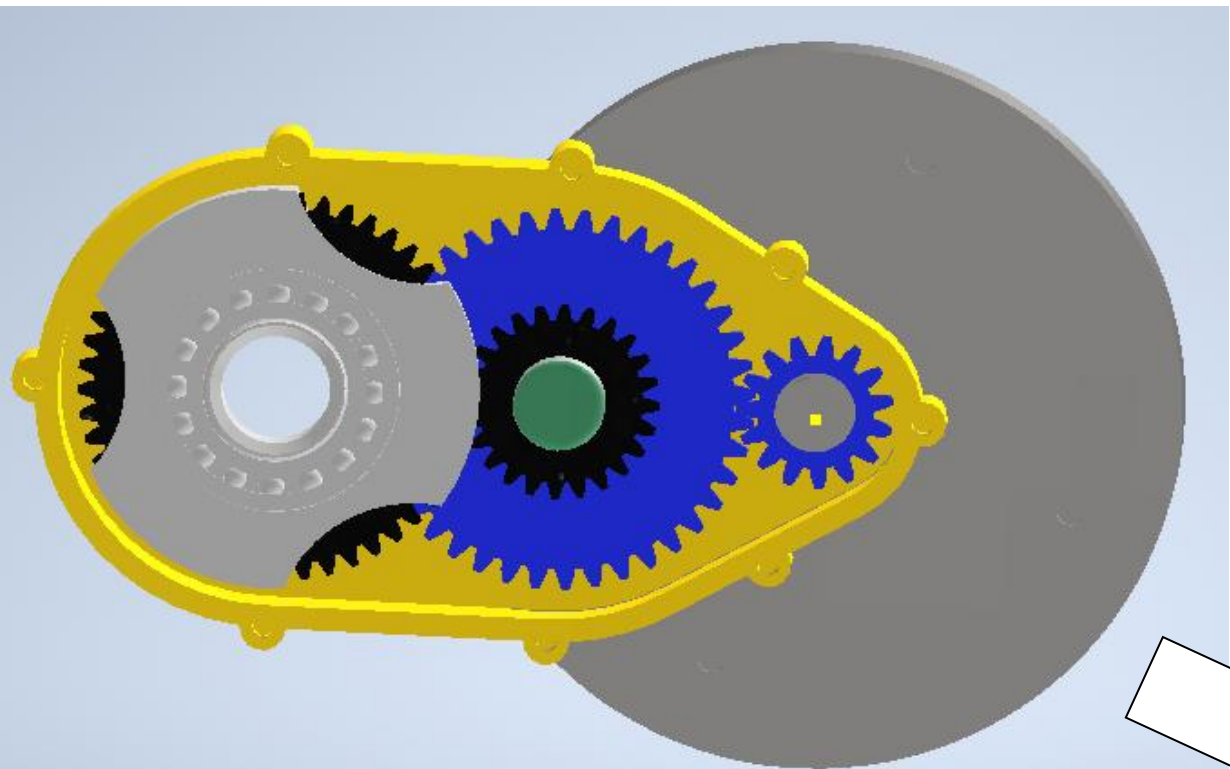


Figure 7: Version 1

Version 2

- More compacted design.
- With this design we had an issue with the motor colliding with the differential.

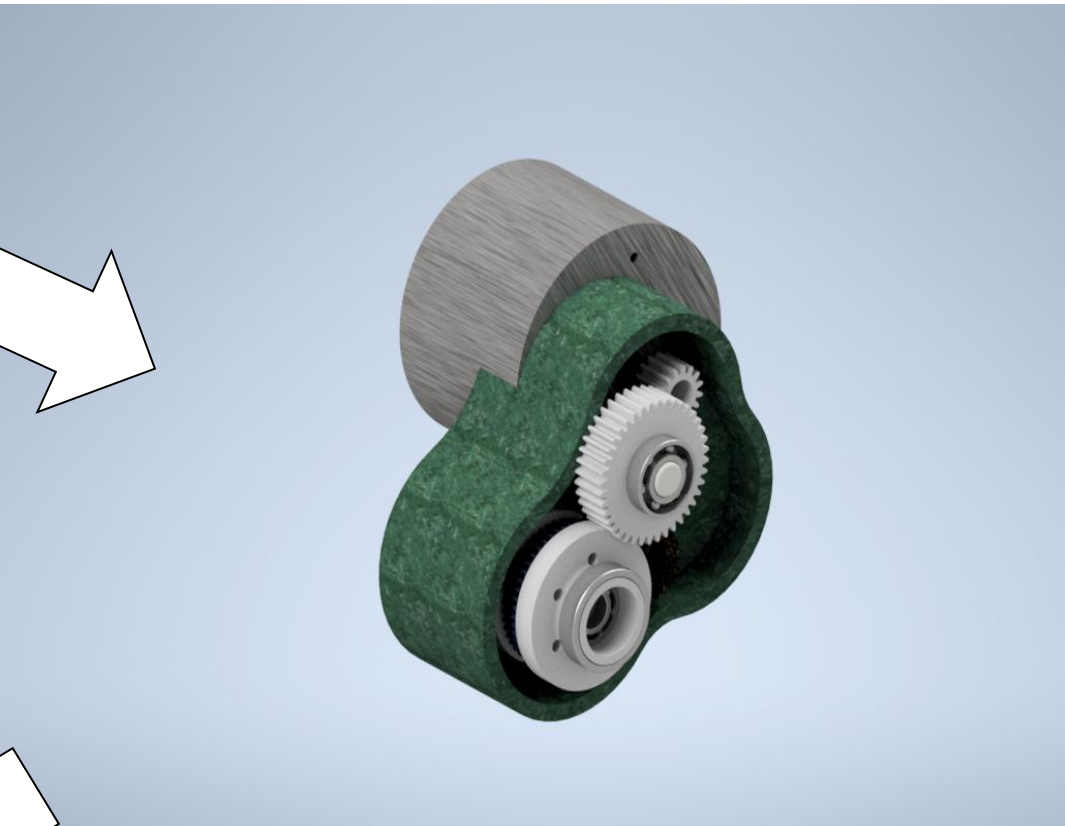


Figure 7: Version 2

Version 3

- Has idler gears which allow proper spacing in the gearbox.
- Biggest model we made with proper spacing and no collision of parts.
- All parts are available on selected websites.

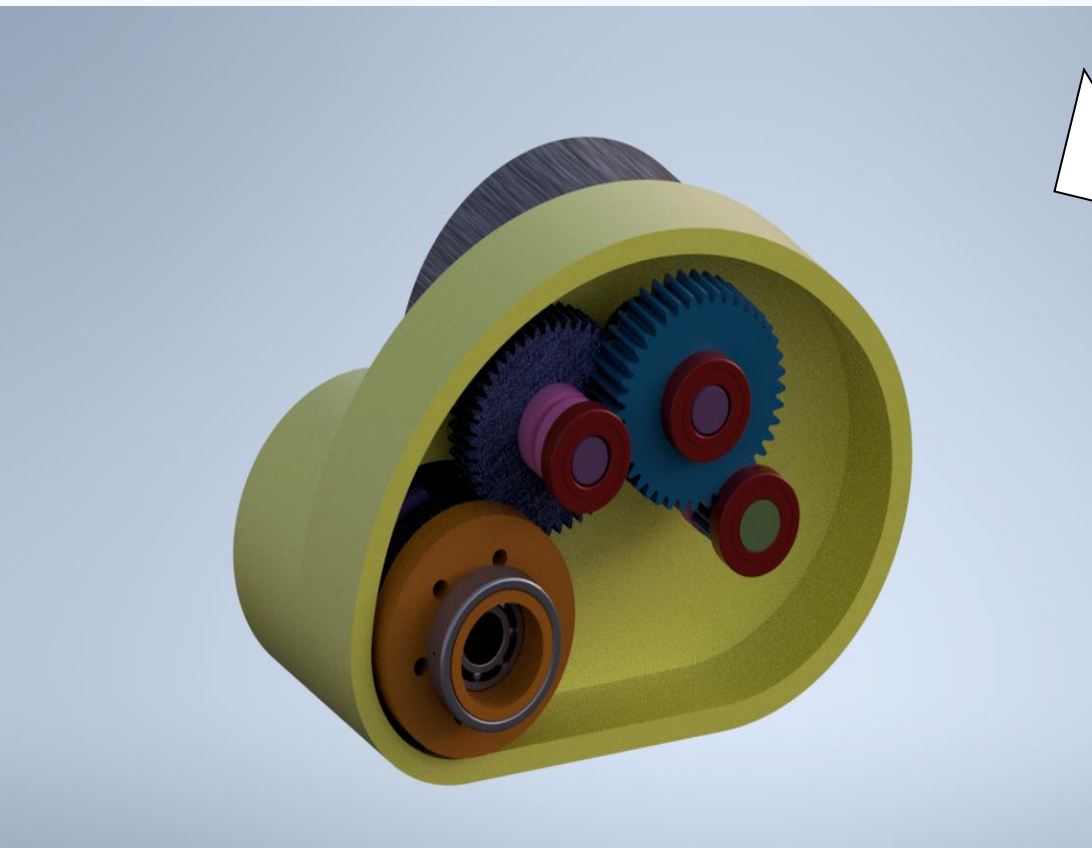


Figure 7: Version 3

*All images are ½ scale

Budget

Item #	Part #	Qty	Name	Material	Source	\$/Part	Subtotal
1	P001	1	Audi Allroad Center Diff	Steel	Ebay	\$ 259.99	\$ 259.99
2	P002	2	Metal Gear Round Bore 12 Pitch, 48 Teeth	1020 Carbon Steel	McMaster-Carr	\$ 141.18	\$ 282.36
3	P003	1	Metal Gear Round Bore 10 Pitch, 15 Teeth	1117 Carbon Steel	McMaster-Carr	\$ 63.23	\$ 63.23
4	P004	1	Metal Gear Round Bore 10 Pitch, 40 Teeth	1117 Carbon Steel	McMaster-Carr	\$ 164.02	\$ 164.02
5	P005	1	Metal Gear Round Bore 12 Pitch, 24 Teeth	1020 Carbon Steel	McMaster-Carr	\$ 74.80	\$ 74.80
6	P006	1	Four Piece Clamping Collar 7/8 inch	1045 Steel	Amazon	\$ 11.99	\$ 11.99
7	P007	2	Four Piece Clamping Collar 1 inch	Carbon Steel	Amazon	\$ 9.99	\$ 19.98
9	P009	6	Sealed Ball Bearing ID: 1 in OD: 2 in	Steel	McMaster-Carr	\$ 13.73	\$ 82.38
10	P010	1	Thrust Ball Bearing ID: 2.5 in OD: 3.969 in	Steel	MSC	\$ 120.46	\$ 120.46
11	P011	2	SUNLU 3kg 3D Printer Filament PLA Plus 1.75mm, 1.75mm Diameter, 3kg (6.6lbs)	PLA	Amazon	\$ 35.99	\$ 71.98
			Large Spool, Black				
Total:							\$ 1,151.190

Table 4