CIRCULAR SAW

Design Exploration Booklet

Tyson Erwin
IND 361

MODULE 1:

Part 1 - About the Chosen Product

MODULE 1:

Part 1 - About the Chosen Product

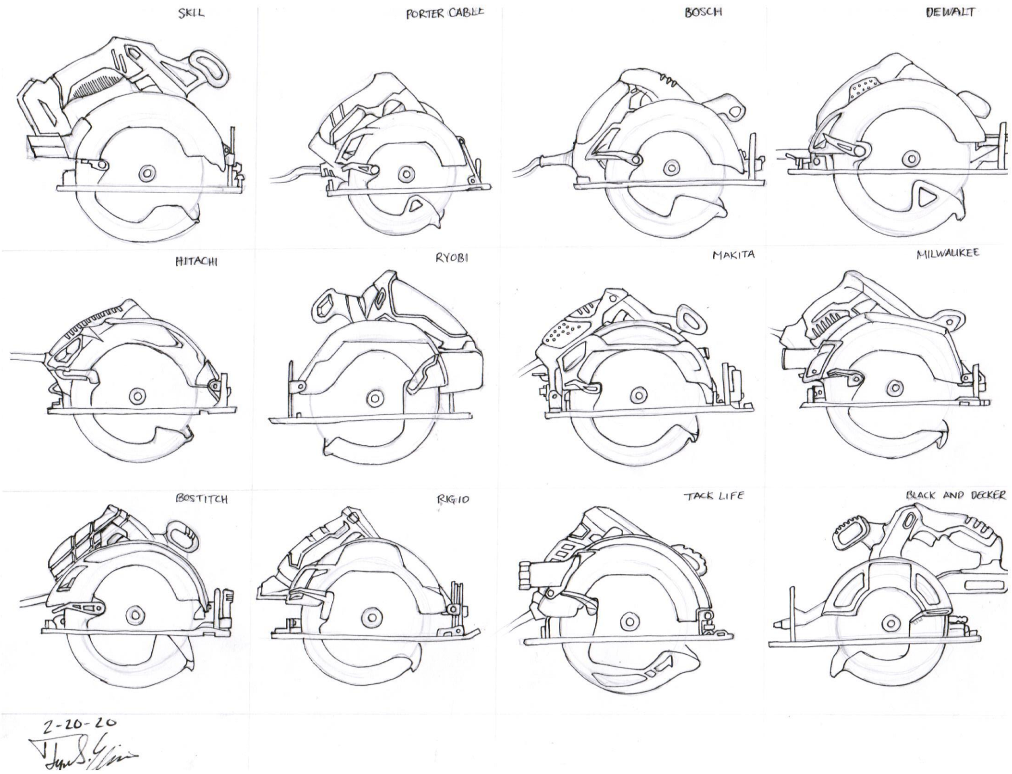
Actionable Insights

Add safety thumb button on side or on the trigger

Dust everywhere creating increased post-operation time

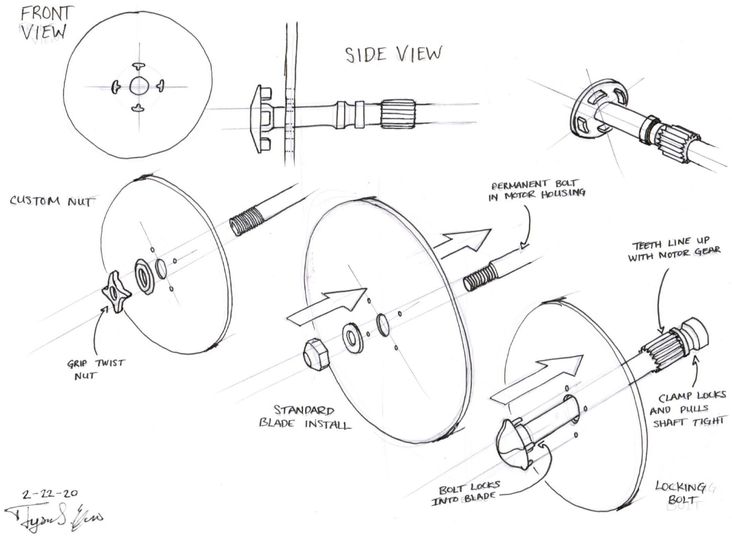
Body of saw should be replaced with a lighter metal

Manufacturer's Versions Sketching



Actionable Insights

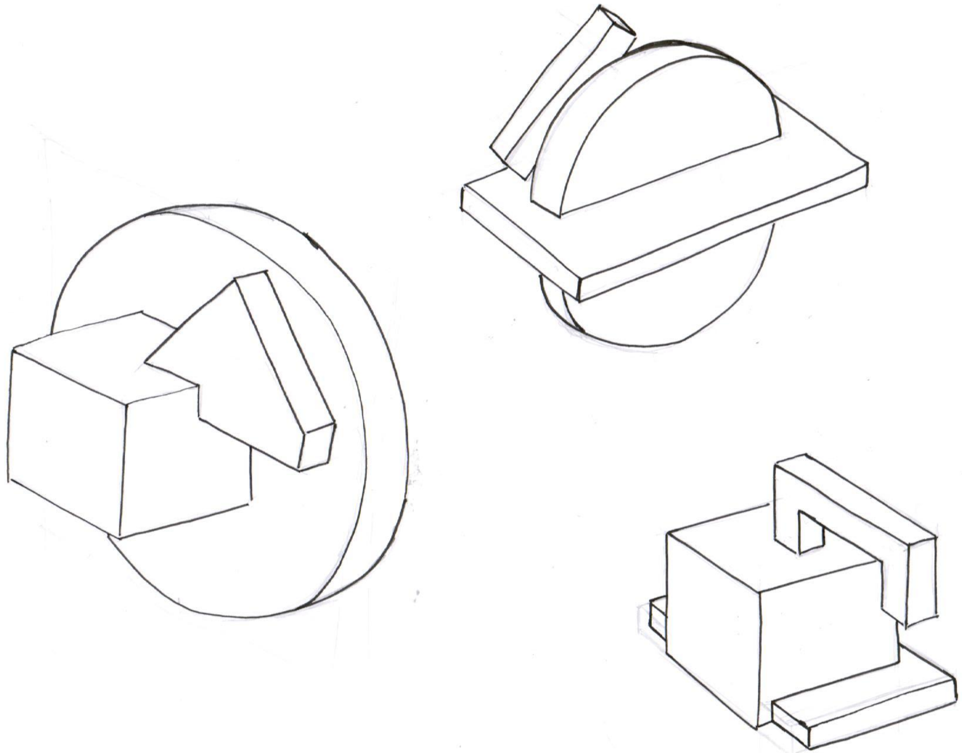
Lighter metals should be used to reduce muscle fatigue



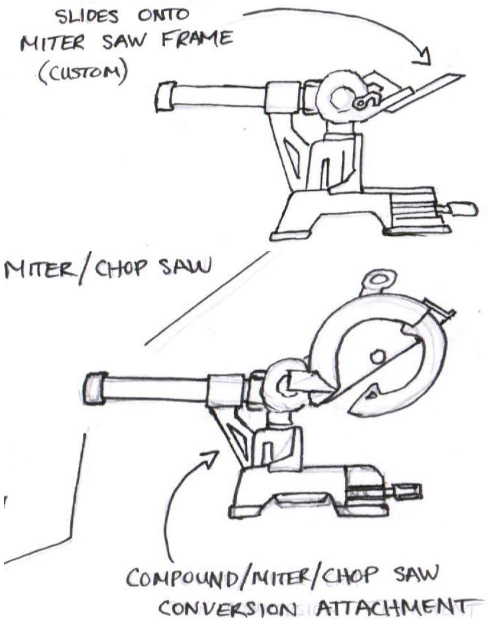
Swapping out blades should be quick and seamless

Removing cord will prevent snags and injury

Form Analysis



Actionable Insights



Make circular saw more prominent in all work environments

Removing cord will prevent snags and injury

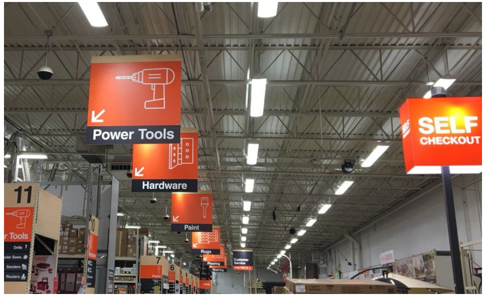
Device that holds saw in upright position when not in use

Form Analysis

Product in Action: User must maintain excellent control of material with one hand and the saw with the other hand.

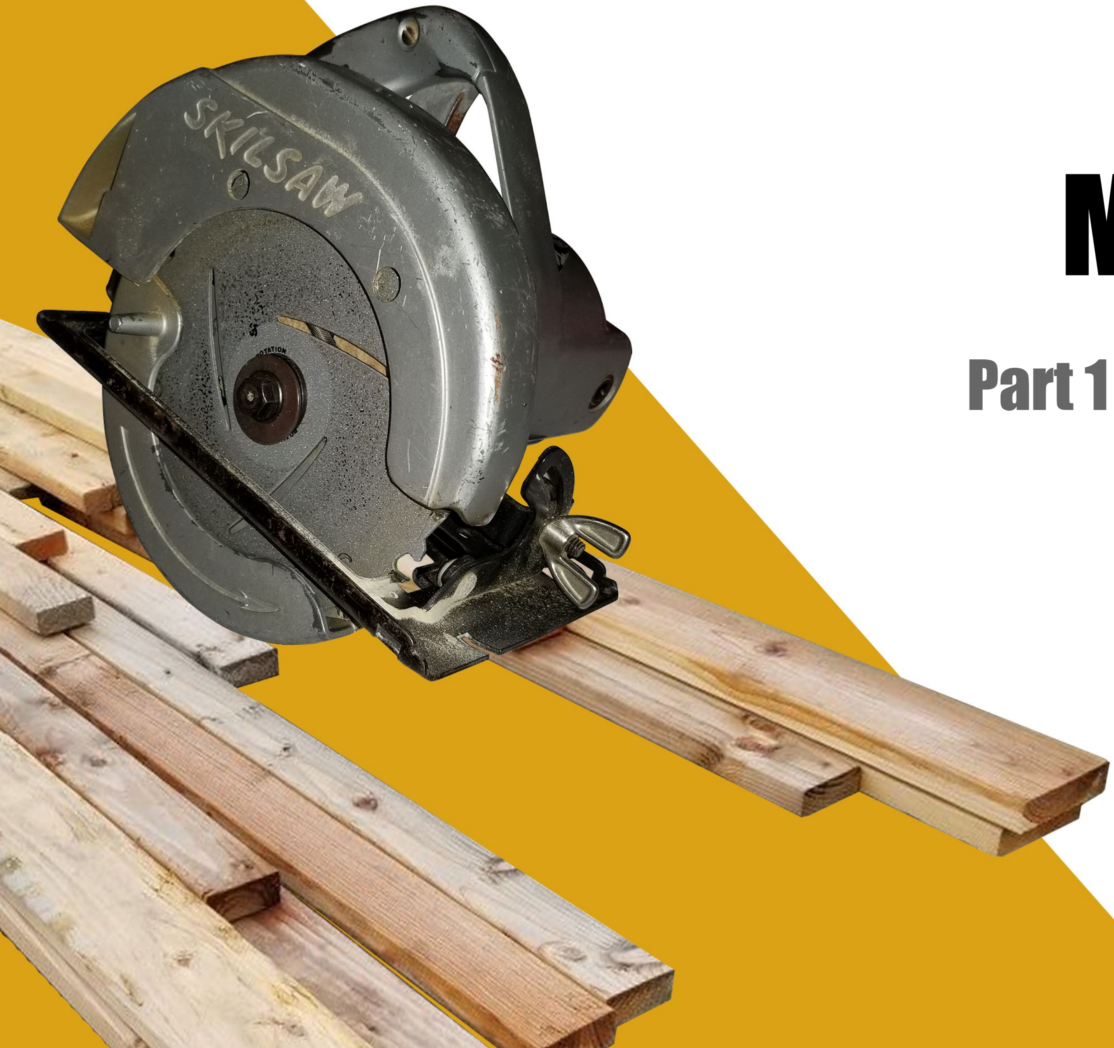
Product in Maintenance: User must remove bolt (with 2 wrenches) to break nut loose, then twist off. Reverse to put blade on.

Product Boundaries



MODULE 2:

Part 1 - Product Boundaries



MODULE 2:

Part 1 - Product Boundaries

Visual User Profile

Circular saws are a necessary tool for the everyday construction worker that builds homes. The circular saw can be also be used in other various job sites that require a specific function.

Life Cycle Assessment

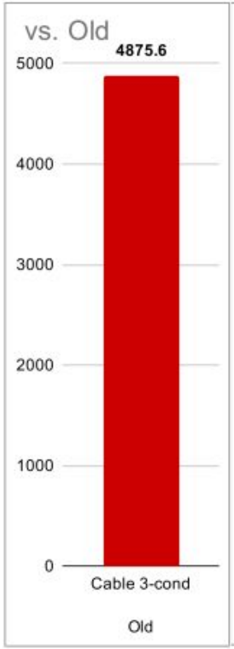
Circul Saw LCA Table													
Part Name	Material of Item/Part	# of Item/Part	Weight/Length	Label	Impact Factors								
					Extraction	Impact/lb	Total Impact	Manufacture Process	Impact/lb	Total Impact	Disposal Process	Impact/lb	Total Impact
Base Plate	Steel Average	1	0.35	lbs	--	5.3	1.855	Steel Sheet Rolling	0.72	0.252	Controlled Landfill	0.02	0.007
Left Body Housing	Magnesium Primary	1	0.2	lbs	--	17	3.4	Iron Casting	18.5	3.7	Open-Pit Landfill (Steels)	2	0.4
Right Body Housing	Magnesium Primary	1	0.7	lbs	--	17	11.9	Iron Casting	18.5	12.95	Open-Pit Landfill (Steels)	2	1.4
Motor Housing	Magnesium Primary	1	0.6	lbs	--	17	10.2	Iron Casting	18.5	11.1	Open-Pit Landfill (Steels)	2	1.2
Blade Guard (Upper)	Magnesium Primary	1	0.5	lbs	--	17	8.5	Iron Casting	18.5	9.25	Open-Pit Landfill (Steels)	2	1
Blade Guard (Lower)	Magnesium Primary	1	0.4	lbs	--	17	6.8	Iron Casting	18.5	7.4	Open-Pit Landfill (Steels)	2	0.8
Trigger	ABS Primary	1	0.06	lbs	--	2.4	0.144	Injection Molding	0.72	0.0432	Controlled Landfill	0.61	0.0366
Trigger Housing	ABS Primary	1	0.09	lbs	--	2.4	0.216	Injection Molding	0.72	0.0648	Controlled Landfill	0.61	0.0549
Trigger Circuit Board	Circuit board, Pb	1	0.01	lbs	--	-	0.01	-	86	0.86	Controlled Landfill	3.6	0.036
Screw Short	Stainless Steel	2	0.02	lbs	--	13	0.26	S.steel Turning	13	0.26	Controlled Landfill	0.51	0.0102
Screw Medium	Stainless Steel	5	0.1	lbs	--	13	1.3	S.steel Turning	13	1.3	Controlled Landfill	0.51	0.051
Screw Long	Stainless Steel	2	0.06	lbs	--	13	0.78	S.steel Turning	13	0.78	Controlled Landfill	0.51	0.0306
Blade Bolt/Nut	Stainless Steel	1	0.15	lbs	--	13	1.95	S.steel Turning	13	1.95	Controlled Landfill	0.51	0.0765
Wing Nut	Stainless Steel	2	0.16	lbs	--	13	2.08	S.steel CNC Turning	14	2.24	Controlled Landfill	0.51	0.0816
Lower Blade Guard Lever	Aluminum Primary	1	0.1	lbs	--	13	1.3	Al. forging 1 stroke	0.5	0.05	Controlled Landfill	0.39	0.039
Motor Fan	ABS Primary	1	0.05	lbs	--	2.4	0.12	Injection Molding	0.72	0.036	Controlled Landfill	0.61	0.0305
Motor Brush	Pig Iron	2	0.12	lbs	--	0.92	0.1104	Iron Casting	18.5	2.22	Controlled Landfill (Lead)	3.6	0.432
Motor Brush Contact	Copper Primary	8	0.24	lbs	--	140	33.6	Copper Sheet Rolling	1.5	0.36	Controlled Landfill	0.98	0.2352
Motor Brush Spring	Steel Low Alloy	4	0.12	lbs	--	7.6	0.912	Steel Drawing auto	0.18	0.0216	Controlled Landfill	0.02	0.0024
Motor Wire Cover	Pig Iron	8	0.64	lbs	--	0.92	0.5888	Iron Casting	18.5	11.84	Controlled Landfill (Lead)	3.6	2.304
Motor Brush Casing	ABS Primary	2	0.02	lbs	--	2.4	0.048	Injection Molding	0.72	0.0144	Controlled Landfill	0.61	0.0122
Motor Bushing	Stainless Steel	2	0.18	lbs	--	13	2.34	S.steel CNC Turning	14	2.52	Controlled Landfill	0.51	0.0918
Motor Outer Wire Coil	Copper Primary	1	0.3	lbs	--	140	42	Copper Wire Drawing	1.6	0.48	Controlled Landfill	0.98	0.294
Motor Inner Wire Coil	Copper Primary	1	0.35	lbs	--	140	49	Copper Wire Drawing	1.6	0.56	Controlled Landfill	0.98	0.343
Wire & Insulator	Cable 3-cond	1	8	in	--	1	8	Generic Rubber	0.7	5.6	Open-Air Incineration	70	560
Gear	Stainless Steel	2	0.84	lbs	--	13	10.92	S.steel Milling	13	10.92	Controlled Landfill	0.51	0.4284
Gear Pin	Stainless Steel	2	0.3	lbs	--	13	3.9	S.steel rolling	1.2	0.36	Controlled Landfill	0.51	0.153
Power Cord & Insulator	Cable 3-cond	1	60	in	--	1	60	Generic Rubber	0.7	42	Open-Air Incineration	70	4200
		Total:	#REF!			Total:	262.2342		Total:	129.132		Total:	4769.5499

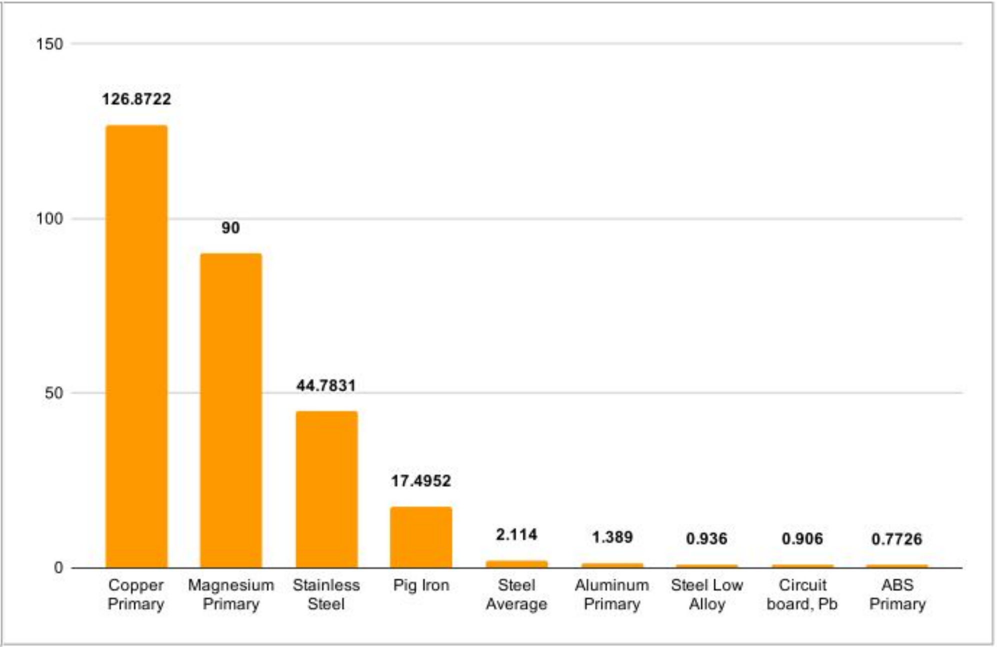
15yrs	7 hr/yr	105 hrs/yr
115V	9.0 amp	108,675 kwh
6.93lbs	1731 mi @ 3/ton-mi	1.99 ton-mi

Overall Impact Total =	5160.9161	5170 Okala
Impact/Hour =	737.2737286	740 Okala/hr

Estimated Impacts

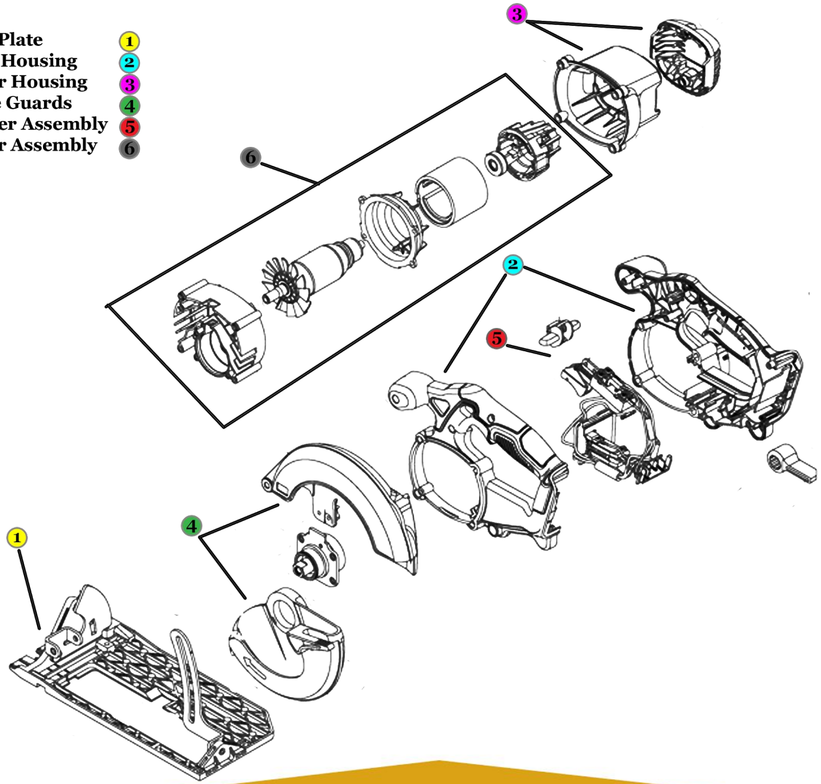
Old	
Steel Average	2.114
Magnesium Primary	90
ABS Primary	0.7726
Circuit board, Pb	0.906
Stainless Steel	44.7831
Pig Iron	17.4952
Steel Low Alloy	0.936
Copper Primary	126.8722
Cable 3-cond	4875.6
Aluminum Primary	1.389





Exploded View

- Base Plate 1
- Body Housing 2
- Motor Housing 3
- Blade Guards 4
- Trigger Assembly 5
- Motor Assembly 6



Actionable Insights

1. Reduce weight in the saw by using a high strength nylon polymer for housings and blade guards.
2. Internal rechargeable battery to eliminate the use and disposal of rubberized power cords.
3. Use a brushless motor to reduce weight while maintaining life expectancy.
4. 3 speed variable switch to adjust to user needs, materials, and extending battery life.
5. Reduce overmolding and unnecessary material production.
6. Explore moto configurations for ergonomic use.

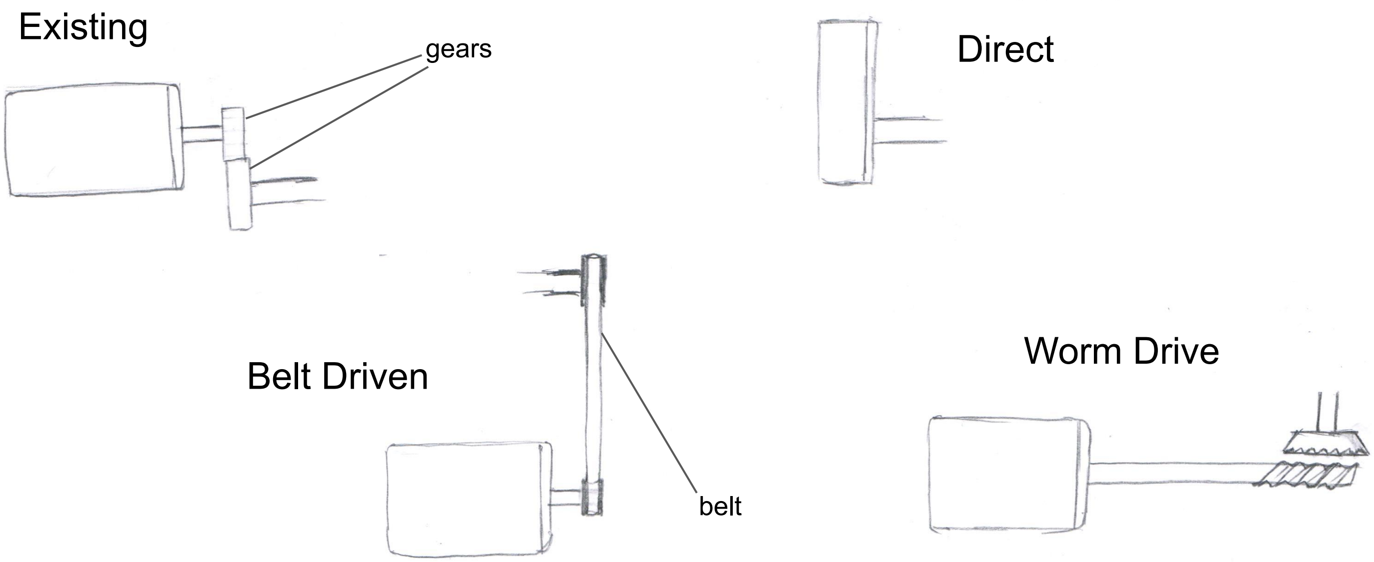
MODULE 2:

Part 2 - Drawings/Models

MODULE 2:

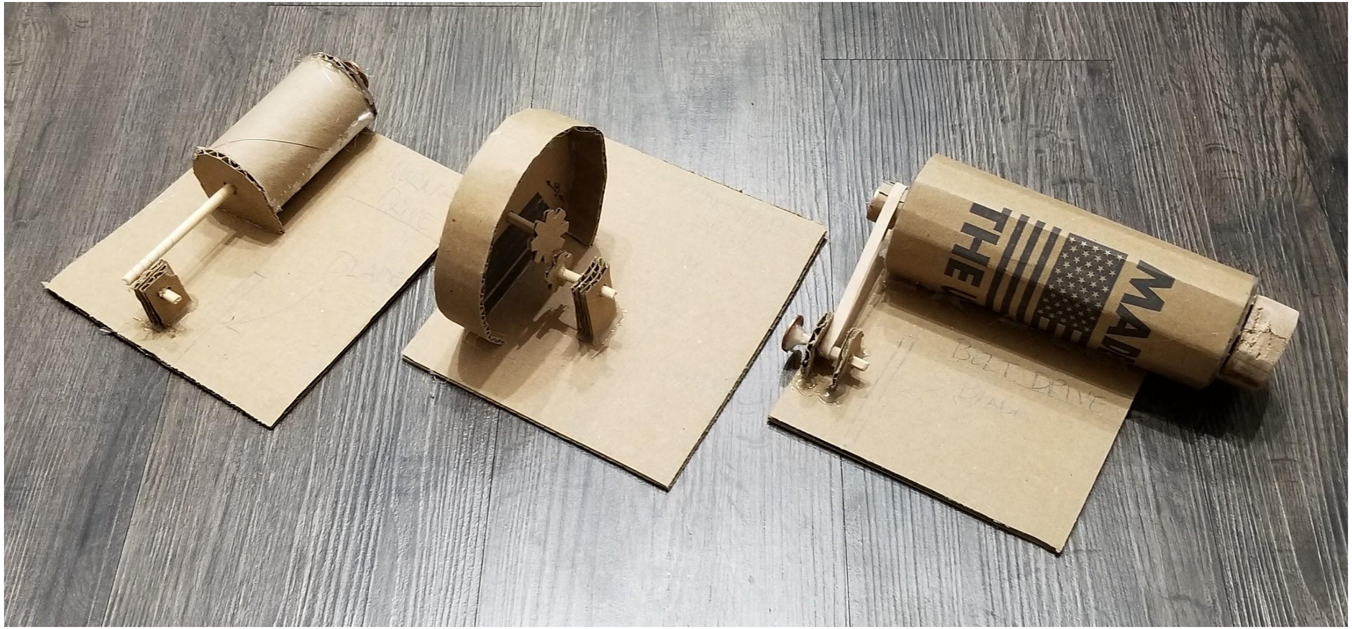
Part 2 - Drawings/Models

Existing and 3 new Drive-Train Config.



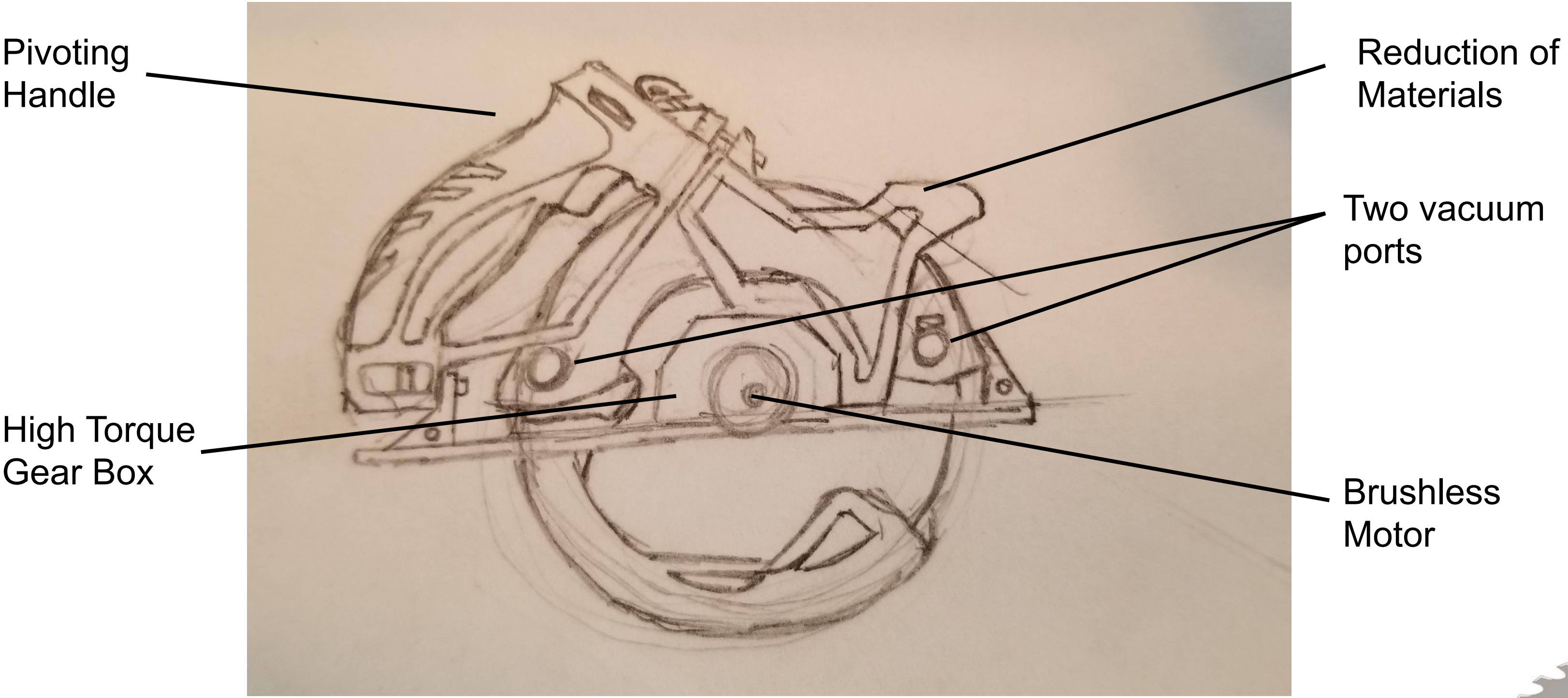
Motor Technology

3 Motor Variations



1:1 Scale Model Cardboard

1:1 Scale Model Cardboard



Improvement Opportunities

-Reduction of overall weight to the housing components and blade guards will significantly reduce user fatigue during operation.

-Creating a multi-tool function with a miter saw will allow the user to purchase at a lower cost while achieving the same goal.

-Incorporating a lower Amp/hr battery with a ‘between use’ rechargeable station (the case) will reduce weight and overall Okala impact factors.

Design Statement

"A worker who *can* is much more effective than a worker who *can't*. Give workers a tool that will improve their performance"

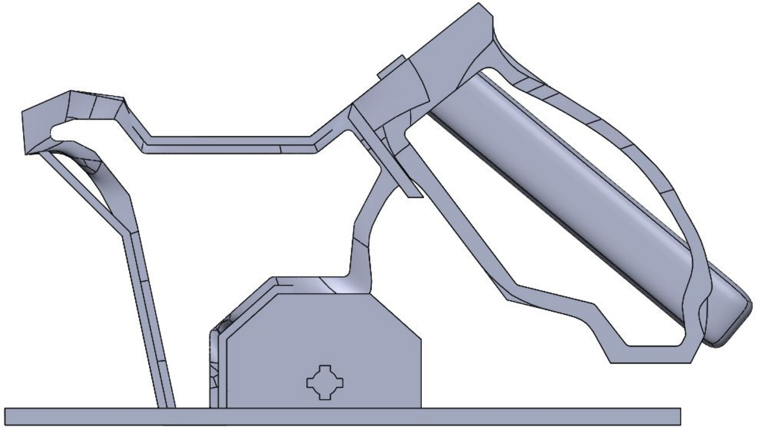
MODULE 3:

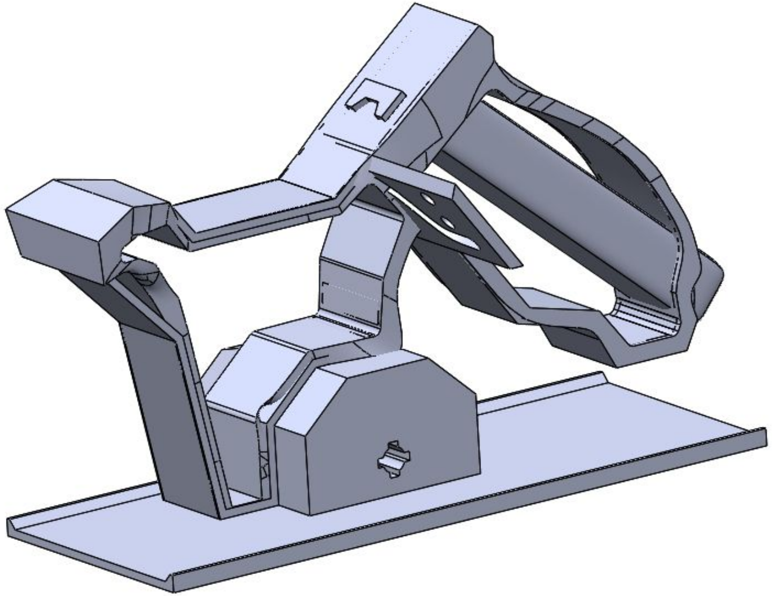
Part 1 - Digital Model Process

MODULE 3:

Part 1 - Digital Model Process

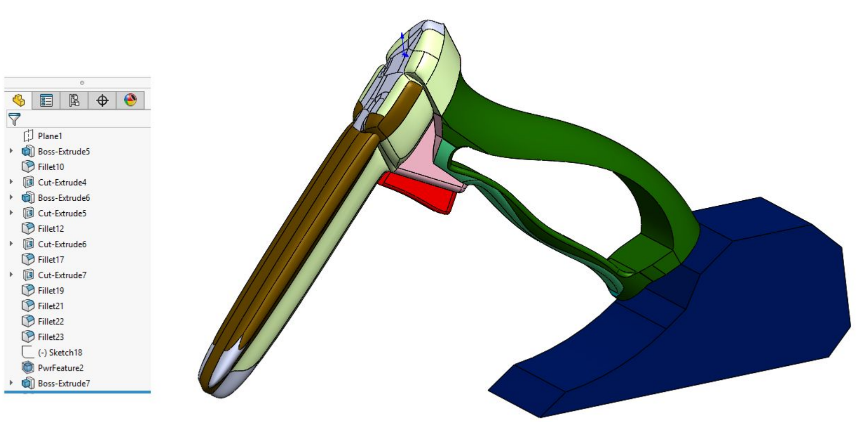
Process

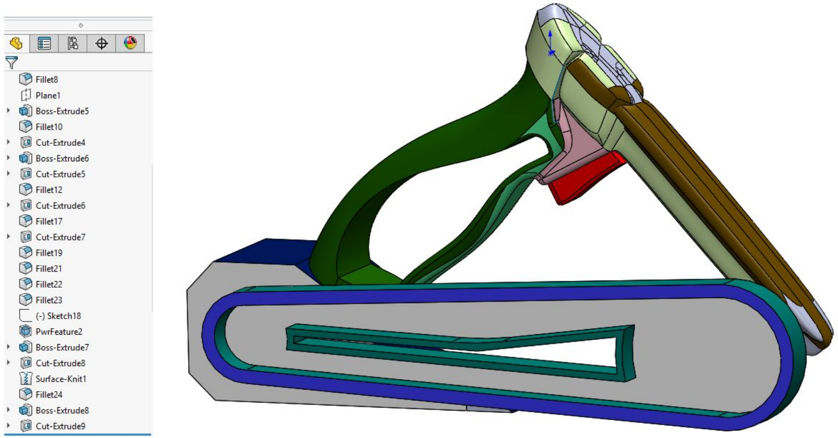




First rough 3D model to give myself a sense of direction and layout.

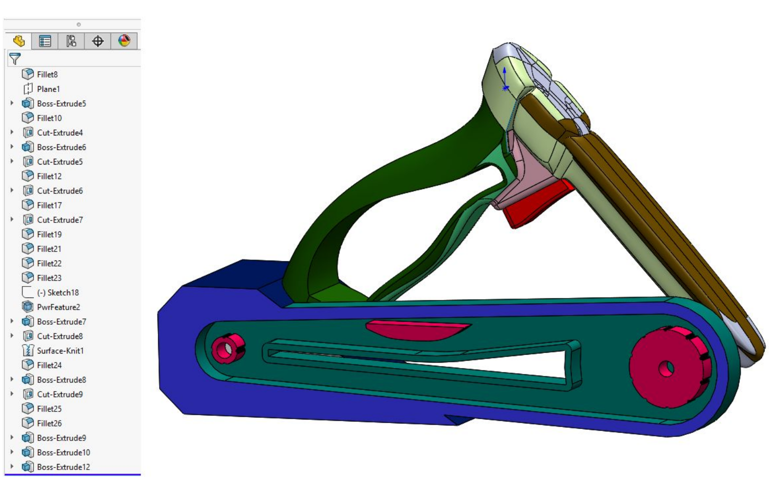
Process

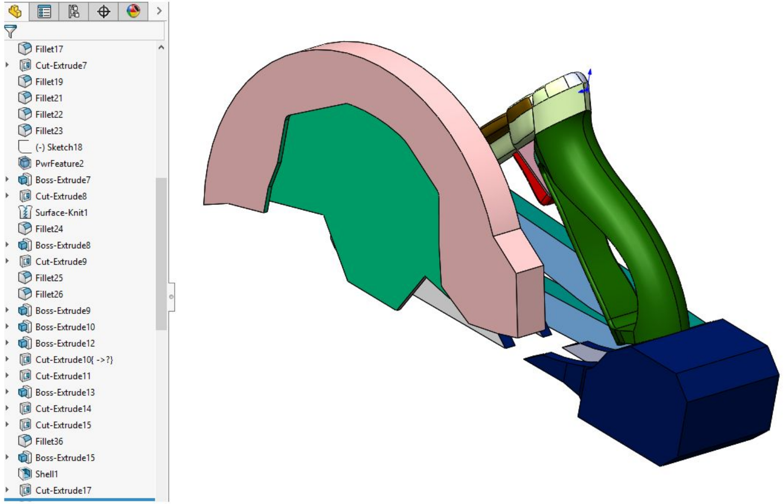




I began creating the 3D design from the handle to give myself the proper angle. This gave me the ability to space everything out accordingly.

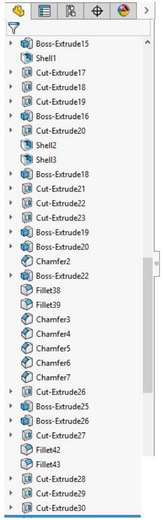
Process

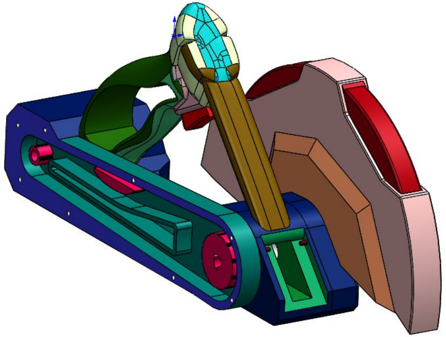


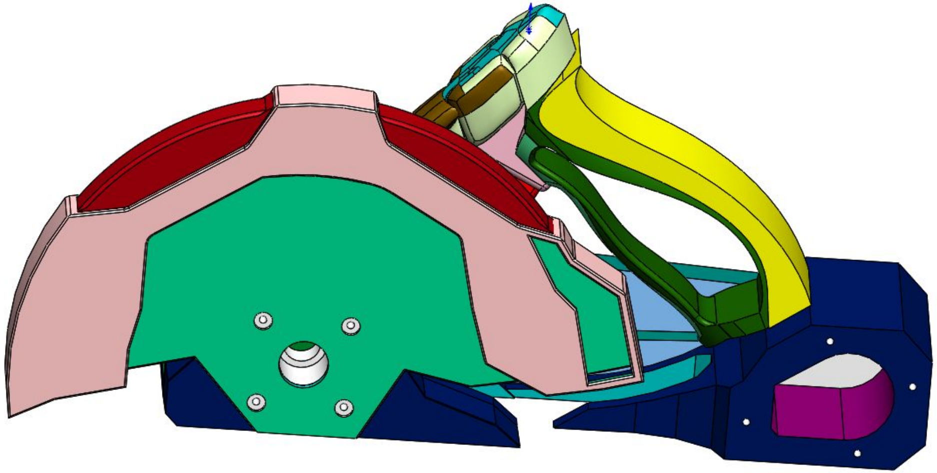


I then developed the belt drive system along the side. This would give me center points where the motor will be positioned as well as the blade system.

Process

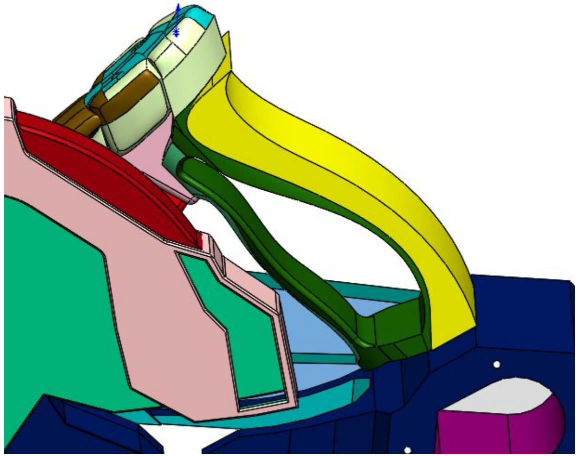


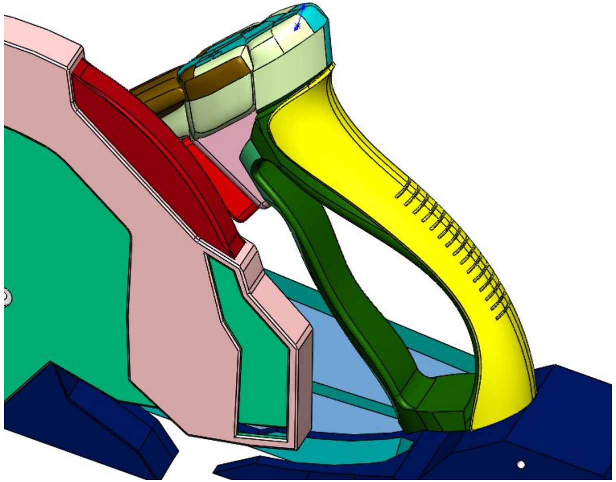




Once the belt drive was complete, I moved on to the upper blade guard and the motor housing compartment. Future development on this saw will include shortening the gap between the motor and blade, positioning the motor more under the handle.

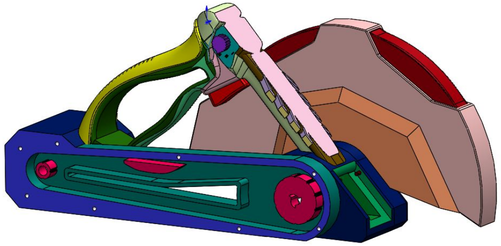
Process

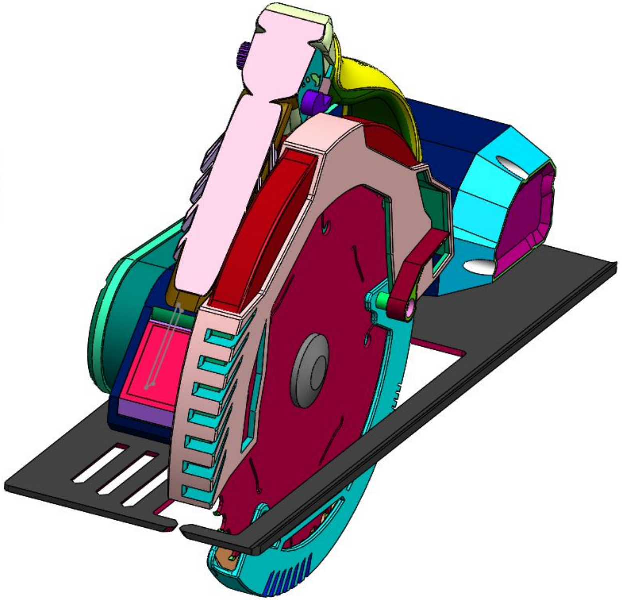


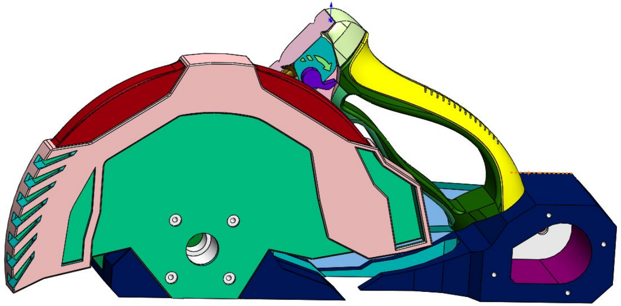


Adding some special features such as a rubber grip was next. I considered that the grip would be more universal in the sense that different grip patterns can easily snap into place on the back of the handle.

Process







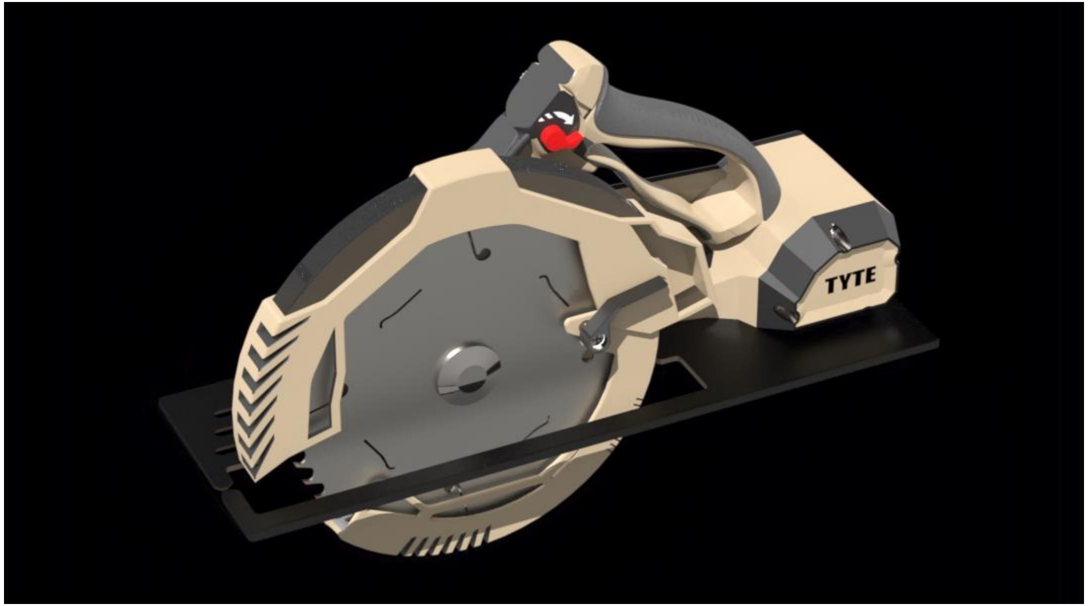
A few details added at the end to give the saw a bit more character and function such as the blade guard cutouts. I the middle is the final assembled saw with color coded faces and bodies to be rendered in SolidWorks Visualize or Keyshot.

MODULE 3:
Part 2 - Digital Model

MODULE 3:

Part 2 - Digital Model

Color Scheme

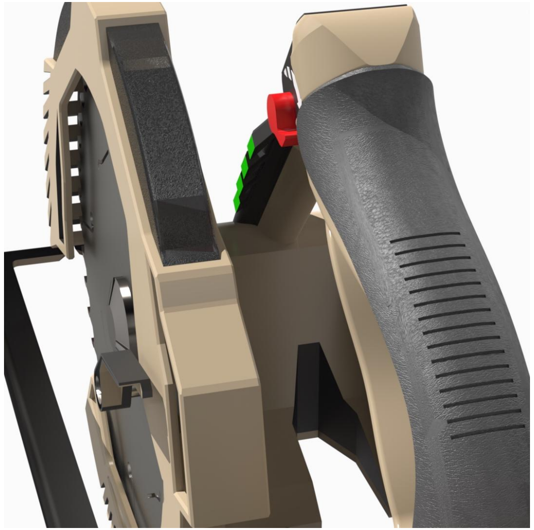


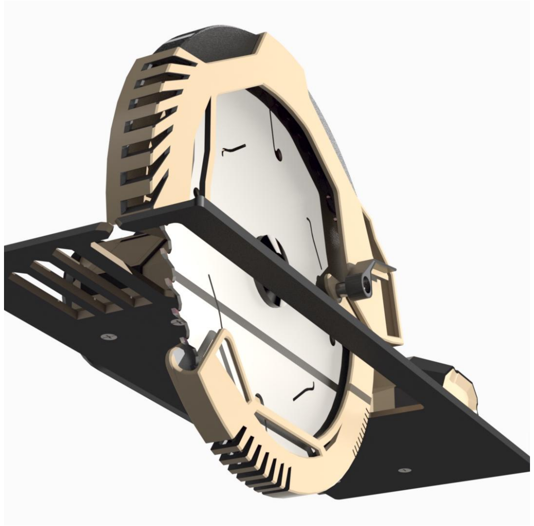
My target color scheme to begin with was to be something completely different in the industry. Such as greys and blacks becoming more popular, I decided to go with a very nuetral color scheme, which I ended up liking very much

Color Scheme

My thought process came from the housing market. Beige, browns, and desert colors alike were very popular. I feel that current modern colors will soon phase out back to the original desert-like colors used in the housing market.

Materials



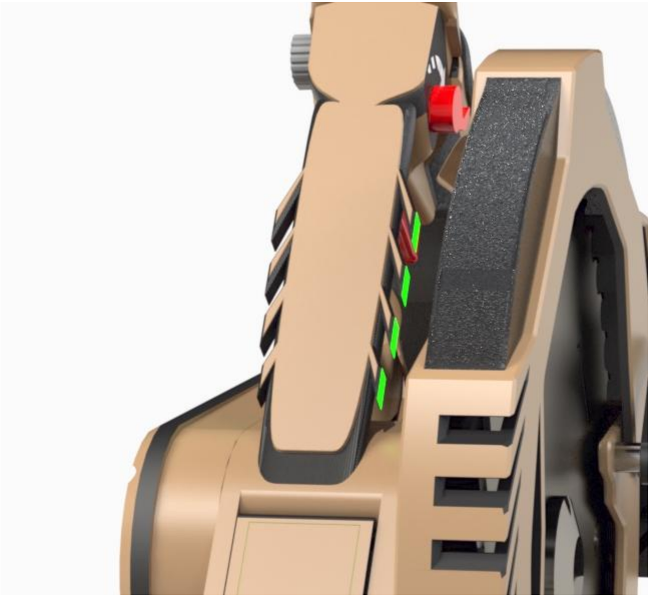


The paint will be of a medium gloss with the grip being of a synthetic leather/rubber material for comfort and grip. A majority of the saw was limiting the use of steels and other heavy materials. Aluminum and kevlar polymers were focal points.

Battery


Lastly, the battery was to be small, powerful, and...well...very powerful. Visually, there needed to be clear indicators on power level. I designed it to be seen from almost every angle to ensure the user knows just how much “fuel” it has left.

Battery



Rather than placing the battery toward the rear of the saw, like more current circular saws on the market, I wanted it to be centralized and out of the way. I was able to integrate it into the shaft that forms the body and keep in center mass.