Design of a non-invasive Hip Exoskeleton

Team Members:

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- Meshal Alghammas
- Abdullah Almarri
- Mohammed Janshah

Project Description

- The goal of the project
- Who can use it.
- Budget
- Sponser
- Client
- Mentor

Figure 1: Picture of the design

Design Description

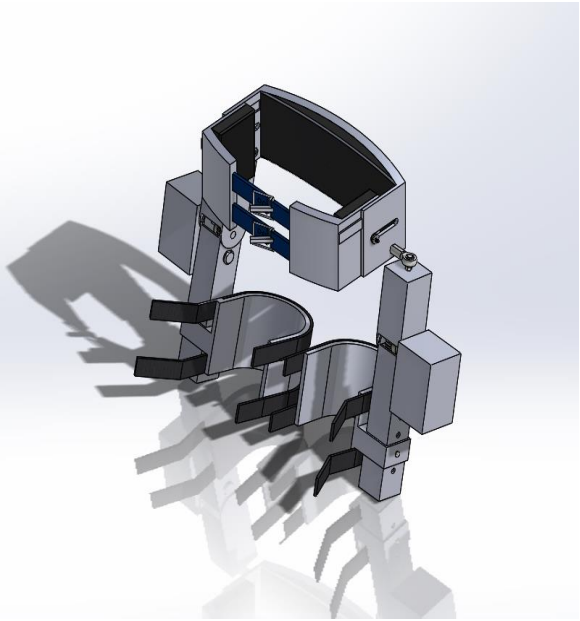


Figure 2: Old CAD Isometric View

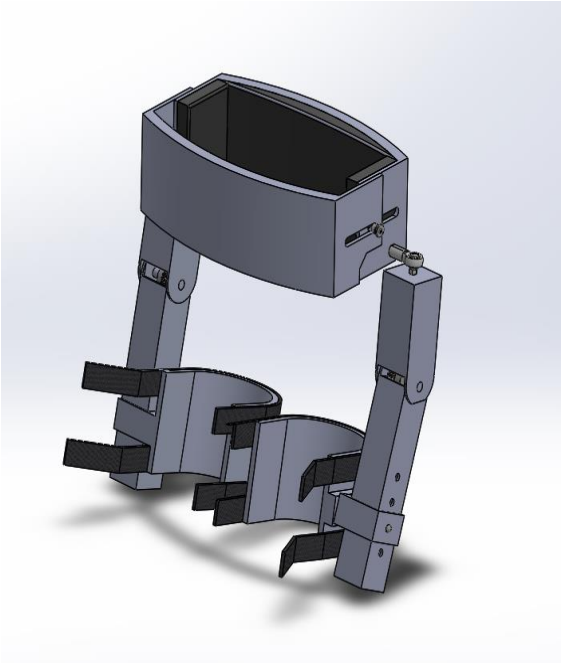


Figure 3: CAD Isometric View

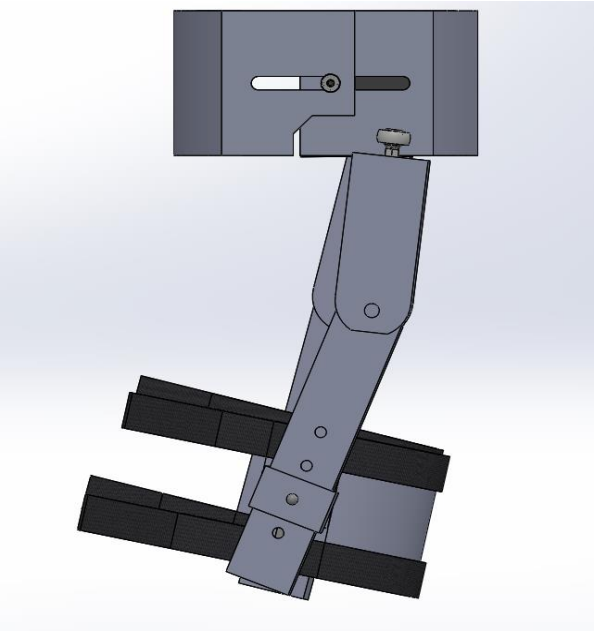


Figure 4: CAD Right View

Figure 5: Gear connection inside the tube

Figure 6: Tube Welding Area

Figure 7: Thigh Brace connection

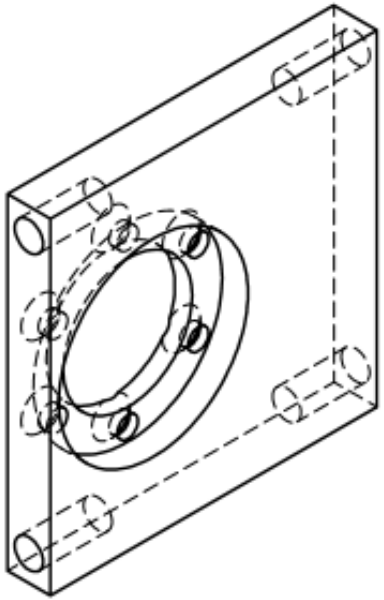


Figure 8: Motor mount

Current State of System

Table [1]

Engineering Requirements (ERs)	Met or Not yet
Material Strength	Met
Cost (Under $2250)	Met
Fitment (Children 6 to 14 years old)	Met
Non-invasive	Met
Torque (8-15 Nm out of the motor)	Not yet
Weight (Under 7 lb)	Not yet

Bill of Materials

Budget : $2250

Spent: $1787.78

Left to be purchased:

- Bearings (4)
- Bevel gear set (1)

Table [2]

Part #	Qty	Part Name	Cost $
1	2	Motors&Gears	$1,259.26
3	1	Frame (lower)	$20.09
2	2	controller	$341.00
3	1	Frame (upper)	$ 29.28
5	2	Ball Joint	$20.53
6	2	Ball Joint Bolt	$6
7	2	hip brace bolt	$8.06
8	2	hip brace nut	$4.49
9	2	Lashing Strap	$16.46
10	1	Pad	$11.59
11	1	ABS Black plastic	$64
12	2	shaft	$7.24
Total Cost to date:			$1,787.78

*See full BOM in Appendix A

Implementation Plan

- Plan for manufacturing and designing the final product.
- Design and material changes.
- Tasks owner: Thigh braces, Hip brace, Supporting frames, Motors and gears.
- Future action items.

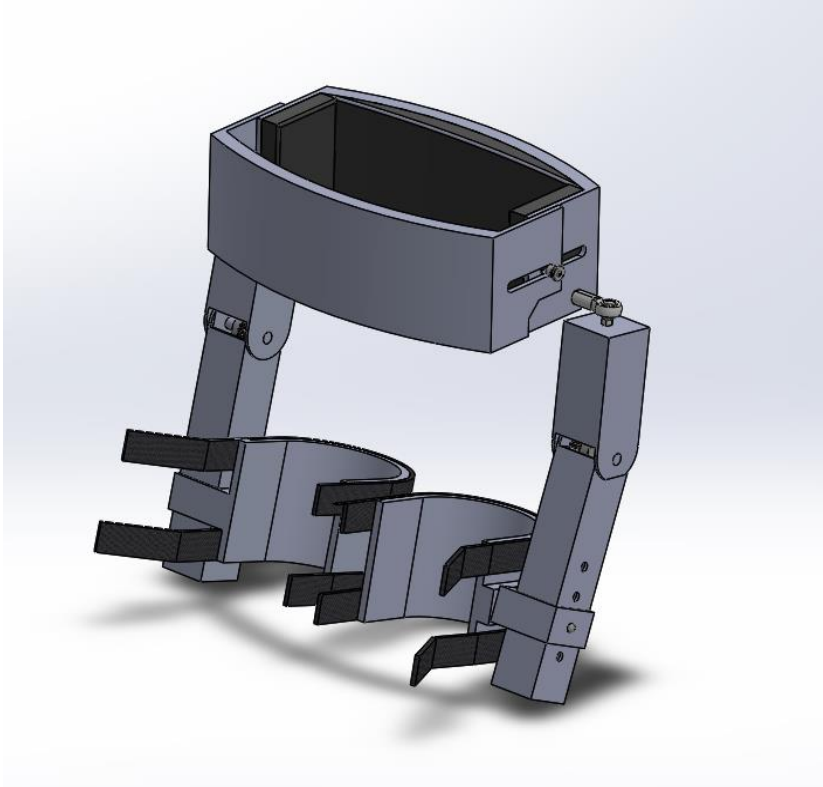


Figure 9: Cad Isometric View

Manufacturing Plan

Table [3]

Manufacturing Project Tasks	Tasks Due
Thigh Braces	02/14/2020
Hip Brace	02/21/2020
Supporting Frames	02/28/2020
Place The motors	03/20/2020
Testing The project	03/20/2020

Testing Plan

Weight

Strength

Range of Motion

Cost

Force

Torque

Conclusion

- Deliver a design that meets all the customer and engineering requirements.

- Staying within the budget.

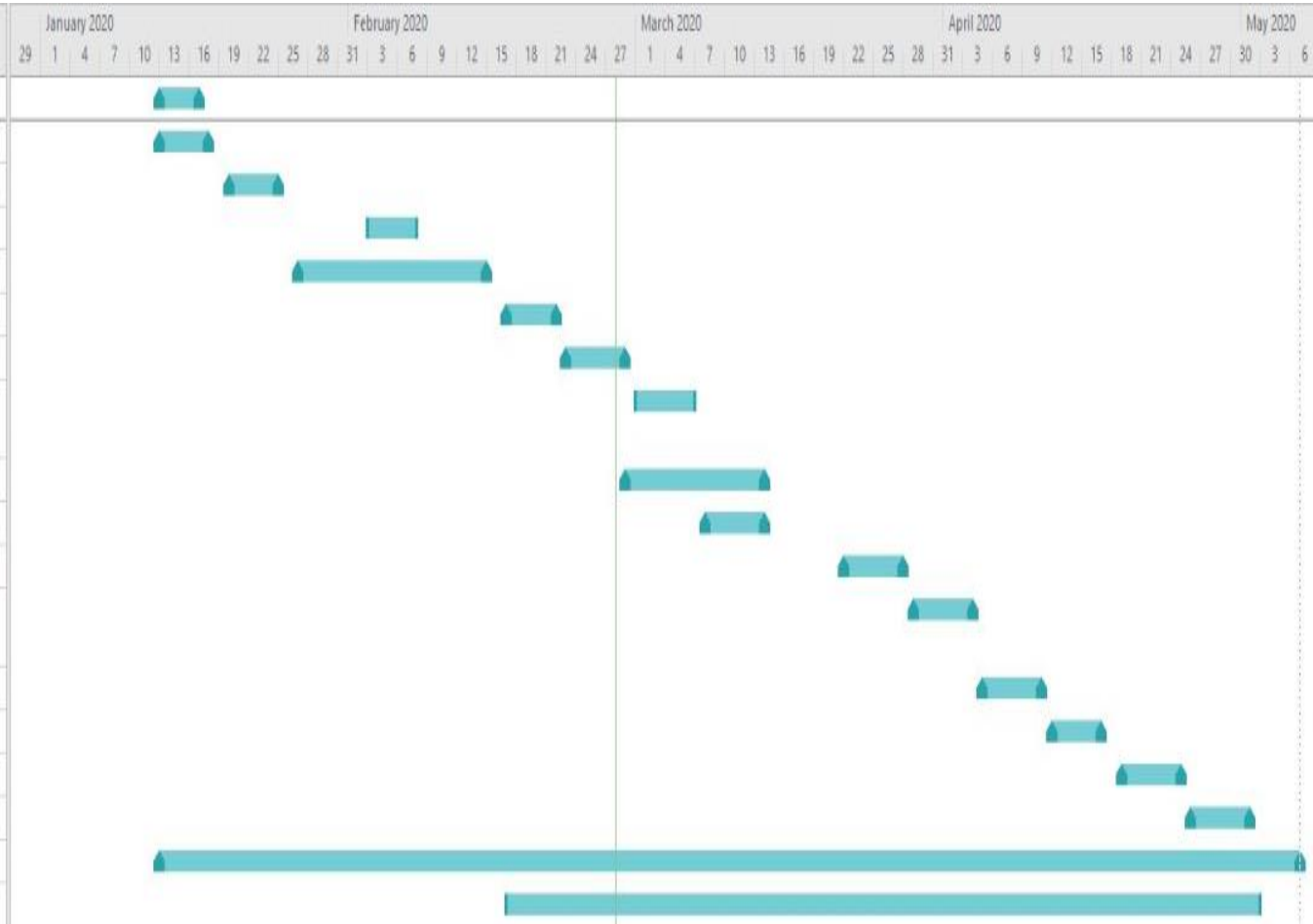
Appendix A: Bill of Materials

Bill of Materials

Team				Team Hip Exoskeleton A				
Part #	**Part Name**	**Qty**	**Description**	**Functions**	**Material**	**Dimensions**	**Cost $**	**Link to Cost estimate**
1	Motors&Gears	2	motor with gearbox in each side (left & right)	actuate thigh movment	Plastic & Metal		$1,259.26	https://www.maxongroup.com/maxon/view/product/gear/planetary/gp22/370782
2	controller	2	ESCON Module 50/5 4-Q servocontroller for DC/EC	Controller	Electrical		$341.00	https://www.maxongroup.com/maxon/view/product/motor/ecmotor/ec4pole/323218
3	Frame (Lower)	1	frame connect the thigh beace with the upper frame	support thigh brace	aluminum	2" x 2", 1/8" x 24"	$20.09	https://www.amazon.com/6063-Aluminum-Hollow-Rectangular-Temper/dp/B000H9JJB0?th=1
4	Frame (upper)	1	frame that support motors and thigh frame (connected to hip joint) (cutting and modification required)	support motors	aluminum	1.125 x 1.25 x 66"	$ 29.28	https://www.amazon.com/Aluminum-6063-T52-Square-Tubing-Length/dp/B000H9OYN8/ref=sr_1_12?keywords=6063-t52%2Bsquare%2Btubing%2C%2Bastm&qid=1582934364&sr=8-1&th=1
5	Ball Joint	2	ball joint in each side to provide required angle movment	angle movement	zink-plated alloy steel	1.4" x 1.8"	$20.53	https://www.mcmaster.com/60745k833
6	Ball Joint Bolt	2	bolt to hold the ball joint to the hip brace	holding the ball joint	18-8 stainless steel	3/4"	$6	https://www.mcmaster.com/92949a599
7	hip brace bolt	2	bolts to adjust hip size	adjusment of hip size	grade 5 Titanum	3/4"	$8.06	https://www.mcmaster.com/94081a102
8	hip brace nut	2	nut to adjust hip size	adjusment of hip size	18-8 stainless steel	7/16" x 1/2"	$4.49	https://www.mcmaster.com/91833a125
9	Lashing Strap	2	2 in each thigh brace to fit user size (comes in 2 pack)	thigh fitment	Fabric	8' x 1"	$16.46	https://www.amazon.com/Keeper-85243-Lashing-Strap-Pack/dp/B004PL4H0O/ref=lp_2564000011_1_15?s=industrial&ie=UTF8&qid=1583297512&sr=1-15
10	Pad	1	pads in the hip brace to ensure comfort for the user	comfort	foam	12"x54"x1/8"	$11.59	https://www.amazon.com/Dualplex-Neoprene-Perfect-Cosplay-Padding/dp/B07WDSMVB2
11	ABS Black plastic	1	Thermoplastic sheet for hip and thigh brace	thigh & hip brace	Thermoplastic	1/4""24""48"	$64	https://www.amazon.com/ABS-Plastic-Textured-Vacuum-Forming/dp/B07BX4GW6L
12	shaft	2	two neede for the lower support frame (cutting required)	hold gear	1045 Carbon Steel	6" x 3/8" (D)	$7.24	https://www.mcmaster.com/8632t133
Total Cost Estimate:							$1,787.78	

Appendix B: Gantt Chart

	Task Name	Start	Finish	Task Owner
1	First Day of Class	Mon 1/13/20	Thu 1/16/20	Dr, Trevas
2	Post Mortem Memo	Mon 1/13/20	Fri 1/17/20	Mohammed
3	Self-Learning	Mon 1/20/20	Fri 1/24/20	Individual
4	Hardware Review	Mon 2/3/20	Fri 2/7/20	Abdullah
5	ERs and TPs revamp memo	Mon 1/27/20	Fri 2/14/20	Meshal
6	Website Check 1	Mon 2/17/20	Fri 2/21/20	Mohammed
7	Implementation memo	Sun 2/23/20	Fri 2/28/20	Abdullah
8	Midpoint Presentation and Hardware Review 2	Sun 3/1/20	Fri 3/6/20	Lahdan
9	Individual Analysis II	Sat 2/29/20	Fri 3/13/20	Individual
10	Draft of poster	Sun 3/8/20	Fri 3/13/20	Meshal
11	Website Check 2	Sun 3/22/20	Fri 3/27/20	Mohammed
12	Final Poster, Implementation Memo 2	Sun 3/29/20	Fri 4/3/20	Abdullah
13	Testing Proof Report	Sun 4/5/20	Fri 4/10/20	Lahdan
14	Final Presentation	Sun 4/12/20	Thu 4/16/20	Lahdan
15	UGRADs,Poster Presentation	Sun 4/19/20	Fri 4/24/20	Abdullah
16	Final Report and Op/Assem	Sun 4/26/20	Fri 5/1/20	Lahdan
17	Client Project Handoff	Mon 1/13/20	Wed 5/6/20	Mohammed
18	CAD package, Website Check 3	Mon 2/17/20	Sat 5/2/20	Meshal



Any Questions?