Design of a non-invasive Hip Exoskeleton

Team Members:
1.Mohammed Janshah
2.Meshal Alghammas
3.Abdullah Almarri
4.Lahdan Alfihan

Project Description

- The purpose of the project.
- Existing exoskeletons.
- The aspect of stability.
- Estimated cost around $2250.
- Sponsor
- Client

[1]

Meshal Alghammas

Background Information

- Most of the existing designs of hip exoskeleton have minimal focus on the aspect of stability.
- The development of exoskeleton designs has improved in the last decade.
- Weight of the exoskeleton has been reduced extensively in the new designs. .

Benchmarking

- Use of technology in design.
- Highly capable, intelligent and intuitive devices.
- Lightweight, durable and strong devices.

[2]

Existing Devices

- Ankle-foot orthosis
- Knee-ankle-foot orthosis
- Reciprocating gait orthosis
- Para-step

[3]

[4]

[5]

Literature Review

- Exoskeletons: State-of-the-Art, Design Challenges, and Future Directions (Agarwal and Deshpande, 232).

- Priyanshu Agarwal and Ashish Deshpande.

- Rehabilitation and assist impaired individuals.

[7]

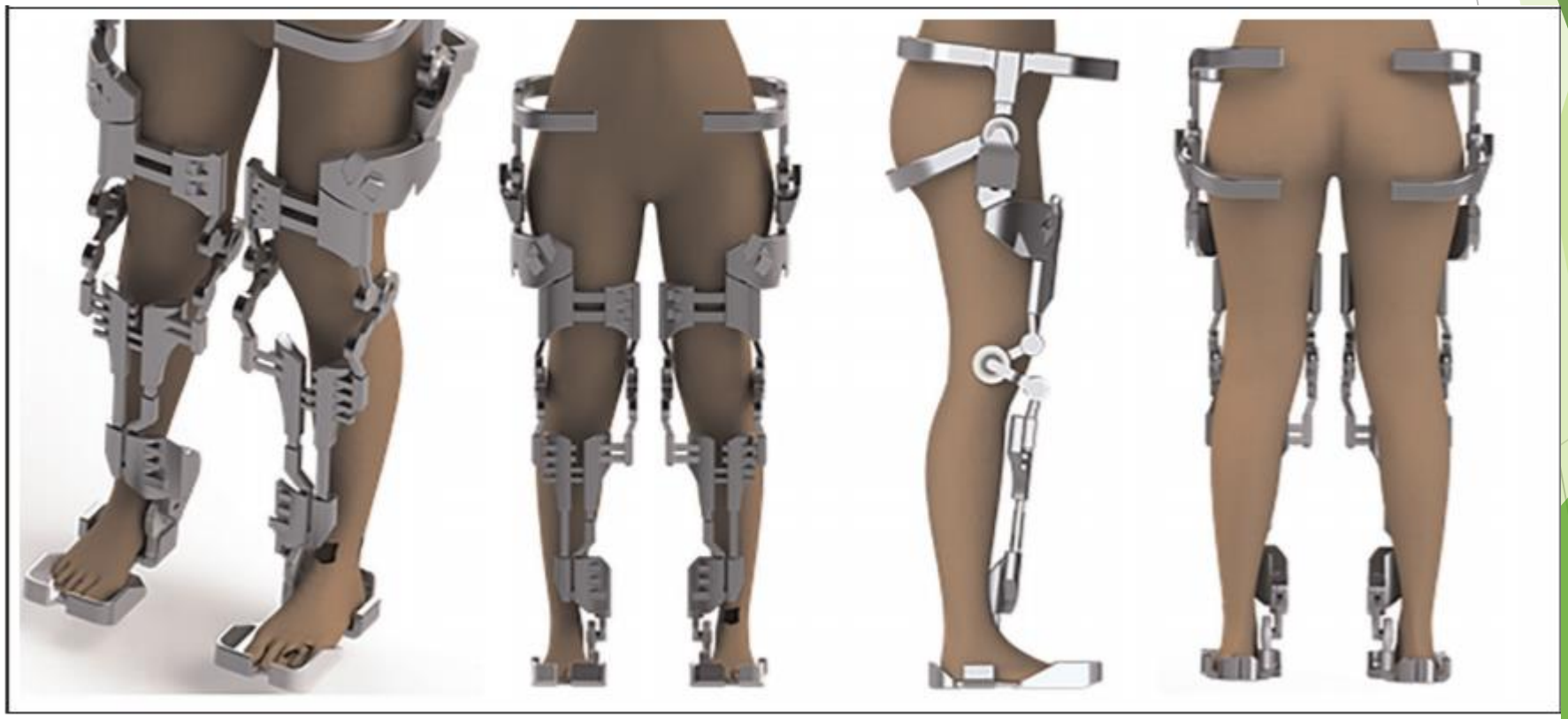
[6]

Literature Review

- Robotic exoskeletons: The current pros and cons (Gorgey, 112).
  - Ashraf Gorgey
  - Rehabilitation and individuals with walking limitation.
  - Benefit and limitation from design perspective.
  - Synchronization.

Literature Review

- Designing the mechanical frame of an active exoskeleton for gait assistance (Daniel Sá, et al., 2)



[8]

Customer Needs

- Low Mobility
- Adjustable size
- Comfortable
- Affordability
- Reliability
- Durability
- Ease of wearing
- Light weight
- Range of motions (forward, backward, passive left and right rotation).

Lahdan Alfihan

Engineering Requirements

- Weight
- Flexibility and Joint Connect
- Force
- Yield Strength
- Low Cost
- Shear Modulus and Young's Modulus
- Torque

Lahdan Alfihan

House of Quality

House of Quality (HoQ)

Customer Requirement	Weight	Engineering Requirement	Weight	Flexural Strength	Force	Yield Strength	Cost	Shear Modulus	Young Modulus	Torque		
Light weight	7		9	5	9	9	5	8	5	9		
Low Mobility	3		2	9	3	3	3	9	7	3		
Adjustable size	9		5	3	1	3	6	6	1	1		
Comfortable	8		7	4	1	7	8	3	5	2		
Reliability	9		1	8	2	9	9	2	3	5		
Durabiilty	9		3	3	1	1	1	5	9	8		
Ease of Wearing	4		7	8	7	1	3	1	2	3		
Range of Motions	9		6	9	3	2	1	3	1	1		
Absolute Technical Importance (ATI)			**288**	**333**	**171**	**267**	**273**	**255**	**230**	**235**		
Relative Technical Importance (RTI)			14%	16%	8%	13%	13%	12%	11%	11%		
Target ER values			80N	200 Gpa	100N	210Gpa	$2,500	80Gpa	215Gpa	20N.m		
Tolerances of Ers			2	5	10	3	500	5	2	2		
Testing Procedure (TP#)			6	4	5	3	8	1	2	7		

Lahdan Alfihan

Schedule & Budget

TASK NAME	START DATE	EDIT DATE	DUE DATE	WEEK 1					WEEK 2					WEEK 3					
				M	T	W	Th	F	M	T	W	Th	F	M	T	W	Th	F	M
presentation 1																			
Team Charter	9/3/2019	9/5/2019	9/6																
CNs/ERs and Background	9/9/2019	9/13	9/16																
Literature Review	9/9	9/13	9/16																
Background & Benchmarking	9/8	9/13	9/16																
Project Description	9/11	9/13	9/16																
Practice Presentation	9/14	9/15	9/16																
presentation 2																			
Project Description			10/7																
Concept Generation			10/7																
Concept Evaluation			10/7																
Budget Planning			10/7																
Practice Presentation			10/17																
Final presentation																			
Prototype			11/4																
Project Description			11/4																
Design Description			11/4																
Design Validation																			
Design Requirements																			
Schedule & Budget																			
Practice Presentation																			

- Our budget for this project is $2250.

Abdullah Almarri

conclusion

- Deliver a device that meets all customer requirements.
- comfortable and lightweight.
- Stay within the budget ($2250).
- Stay on top of the time to prevent any mistakes.

References

- [1] https://www.sciencedirect.com/topics/nursing-and-health-professions/hip-knee-ankle-foot-orthosis [Accessed 13 Sep. 2019].
- [2] https://blogs.umass.edu/mrrl/powered-hip-exoskeleton/ [Accessed 14 Sep. 2019].
- [3] https://dir.indiamart.com/impcat/knee-ankle-foot-orthosis-kafo.html : [Accessed 14 Sep. 2019].
- [4] https://www.healthproductsforyou.com/p-sprystep-dynamic-reinforced-ankle-foot-orthosis.html : [Accessed 14 Sep. 2019].
- [5] https://www.amazon.com/RunXinHong-Abduction-Orthosis-Adjustable-Fixation/dp/B07N2NV23T [Accessed 14 Sep. 2019].
- [6],[7] Agarwal, Priyanshu and Deshpande, Ashish. Exoskeletons: State-of-the-Art, Design Challenges, and Future Directions. 2019; p.234-259.
- [8] Pina, Daniel Sá, et al. "Designing the mechanical frame of an active exoskeleton for gait assistance." Advances in Mechanical Engineering 10.2 (2018).
- Gorgey, Ashraf S. "Robotic exoskeletons: The current pros and cons." *World journal of orthopedics* 9.9 (2018): 112.

Any question?