Lerner Exoskeleton Actuator

Team:18F26

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Content:

- Project Description
- Background & Benchmarking
- Customer & Engineering Requirements
- Schedule & Budget

Project Description

- Design a series elastic actuation system for a robotic lower-extremity exoskeleton
- Cerebral palsy : is a neurological disorder that affects a child's from moving and it is caused by brain damage
- Our device should:
  - Help people with disability
  - Provide clinical gait .

- Our Goal:

 modify the current Exoskeleton to have a flexible movement for the knee(using the engineering requirements)

Client

- Zach Lerner, Ph.D.
- Director of NAU's Biomechatronics Lab
- Our Stakeholders are people with disability

- Why is it important?
- To help people with disability needs

Background and Benchmark

- Definition of Exoskeleton:
  - The Exoskeleton is device used to help and improve the human life.

Where we can use it?

We can use the Exoskeleton on the outer human body.

Exoskeleton applications & different types

- Applications:
  - You can apply it in sever fields:
  - Civilian
  - Medical
  - Military
- Different types:
  - The types of an Exoskeleton is plenty.
  - you can create an one depending on the case.

Background and Benchmark

- Vanderbilt University Exoskeleton (Figure 1):
  1)spinal cord injuries
  2)Use the most upper body strength to walk
- Arizona State University Exoskeleton (Figure 2):
  1)ankle device for stroke recovery therapy
  2) fits perfectly and calibrated to avoid injury

Figure1: Vanderbilt University [1]

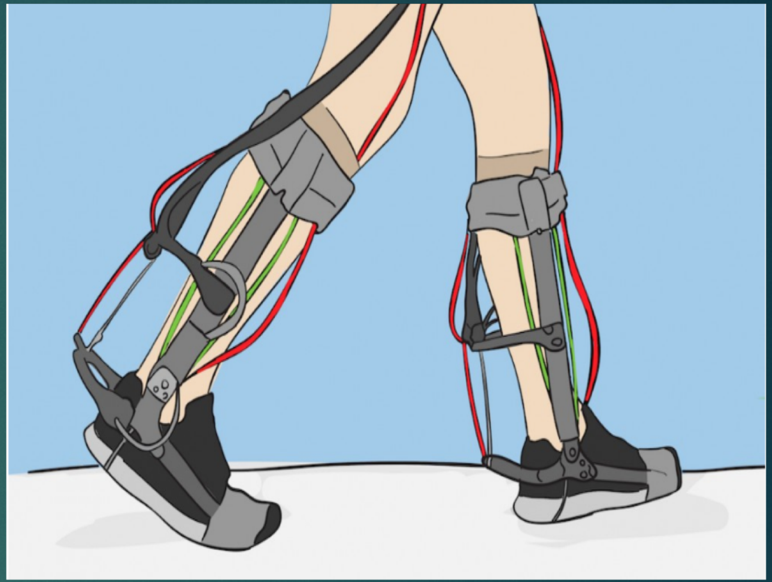

Figure2: Arizona State University [2]

Background and Benchmark

- Eksovest (Figure 3):
  1) Power without pain
  2) over head works

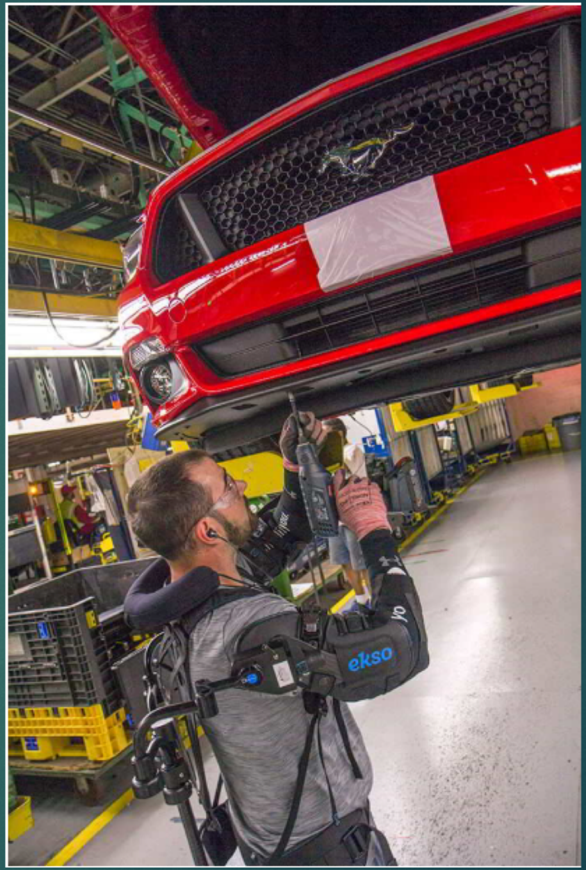

Figure3:eksobionics[3]

Customer & Engineering Requirements

- Design requirement from sponsor

1. To Install a Motor and a Gear box
2. Find the best location to install the spring
3. Find an exact material for the spring
4. Design a spring to meet the requirement

Figure4: CAD

Customer & Engineering Requirements

Table [1]

Customer Requirements	Engineering Requirements
• Measure the required torque	• Provide 0-7Nm of torque
• Make the design lightweight	• Specify the material
• Make the people with disability walk normally	• Find the perfect location for the spring
• It must be noninvasive	• Must not contact the ankle
• Its must be simple as possible	• Not complicated design

House of quality (QFD)

Table [2]

Customer Requirements \ Engineering Requirements	Importance	Provide Torque	Specify Material	Perfect location for spring	Must not contact with ankle	Not complicated design
Measured the required torque	9	9	3	1	1	1
Make the design lightweight	3		1	3	3	3
Make the people with disability walk normaly	3	1		1	3	1
It must be non-invasive	1	3	1	3	1	3
It must be simple as possible	1	1	3	3	3	1
Technical Importance: Raw Score		88	34	27	31	25
Technical Importance: Relative Weight		**42.9%**	**16.6%**	**13.2%**	**15.1%**	**12.2%**
Techanical Target Value		7	-	-	-	-
Units		Nm	-	-	-	-

Gantt Chart

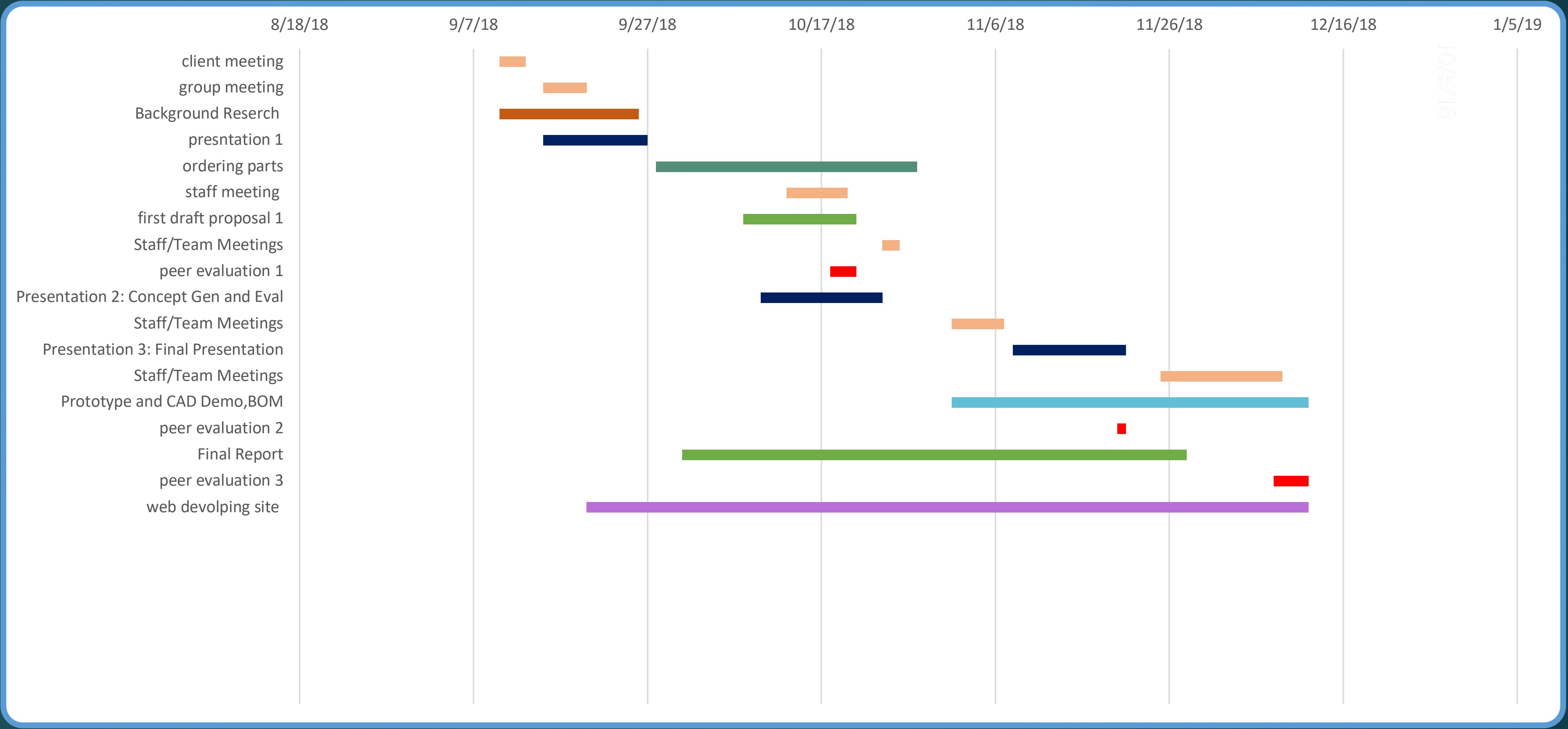

Figure5: Gantt Figure [5]

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Gantt Chart

Table [3]

Task Name	Team member	Start Date	End Date	Duration
client meeting	ALL	9/10/2018	9/13/2018	3
group meeting	ALL	9/15/2018	9/20/2018	5
Background Reserch	ALL	9/10/2018	9/26/2018	16
presntation 1	all	9/15/2018	9/27/2018	12
ordering parts	Barjes&Humood	9/28/2018	10/28/2018	30
staff meeting	All	10/13/2018	10/20/2018	7
first draft proposal 1	ALL	10/8/2018	10/21/2018	13
Staff/Team Meetings	ALL	10/24/2018	10/26/2018	2
peer evaluation 1	individual	10/18/2018	10/21/2018	3
Presentation 2: Concept Gen and Eval	ALL	10/10/2018	10/24/2018	14
Staff/Team Meetings	ALL	11/1/2018	11/7/2018	6
Presentation 3: Final Presentation	ALL	11/8/2018	11/21/2018	13
Staff/Team Meetings	ALL	11/25/2018	11/28/2018	14
Prototype and CAD Demo,BOM	Fawaz &Torki	11/1/2018	12/12/2018	41
peer evaluation 2	individual	11/20/2018	11/21/2018	1
Final Report	ALL	10/1/2018	11/28/2018	58
peer evaluation 3	individual	12/8/2018	12/12/2018	4
web devolping site	Mohammad alali	9/20/2018	12/12/2018	83

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Budget

Table [4]

Part	Price	Total
Motor Ec-4pole22(311536)+gear GP32C(166945)	$713.45	
Manufacturing +spring's	~$600	
		$1313.45

References:

1. RobAid. (2018). *Wearable exoskeleton helps paraplegics walk | RobAid*. [online] Available at: http://www.robaid.com/bionics/wearable-exoskeleton-helps-paraplegics-walk.htm [Accessed 22 Sep. 2018].
2. The Arizona State Press. (2018). *ASU engineering the future in wearable robotics*. [online] Available at: http://www.statepress.com/article/2018/04/spscience-asu-engineering-the-future-in-wearable-robotics [Accessed 22 Sep. 2018].
3. Ekso Bionics. (2018). *EKSOWORKS & FORD PARTNERSHIP Using Exoskeleton Technology | Eksobionics.com*. [online] Available at: https://eksobionics.com/eksoworks/ford/ [Accessed 22 Sep. 2018].

Any Questions ?