

Lerner Robotic Arm

Project Management Report

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Steve Sanghi College of Engineering

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Introduction

The objective of the team is to create a hip mounted robotic arm that will focus on upper limb rehabilitation of stroke survivors. The first semester of the project went well but had its ups and downs in multiple aspects of project management that can be improved. The second semester will try to improve them so that the project can be as successful as possible while staying on track for the reports and assignments that will be made throughout the semester.

Reflection

Looking back at the first semester, there were several positive and negatives that can be seen from a management standpoint of the project. Main positive was that the team was able to design and create the objective of the project while staying on track for other reports and presentation. The main negative the team had was a lack of communication with not just the team but with the client.

Project Management Successes: The following list is the successes that the team deemed to have had over the first half of the project.

- All team assignments were completed on time and received good feedback from the professor and teaching assistants.
- The team was able to implement several ideas that members individually had to create a full design
- The team was able to construct the first few prototypes, being able to show proof of concept.
- The CAD packet delivered towards the end of the semester received positive feedback.

Project Management Room for Improvement: The following list is the things the team believes can be improved with reflection of the first half of the project.

- Better communication with the client to make sure that the team is designing and following the project to what the client wants.
 - **As Client asked, weekly emails will be sent to keep him updated to what the group is doing so; he can help guide us through the semester.**
- Better Communication within the team so that all members understand each other's responsibilities as well as constant conversations between the team.
 - **The team needs to know at a basic level what all members are doing in design and manufacturing processes that other members are**

doing. The team will ask other members what they are doing if the members do not already know. This will help so all members would be able to describe what is currently being done if needed by professors or other professionals.

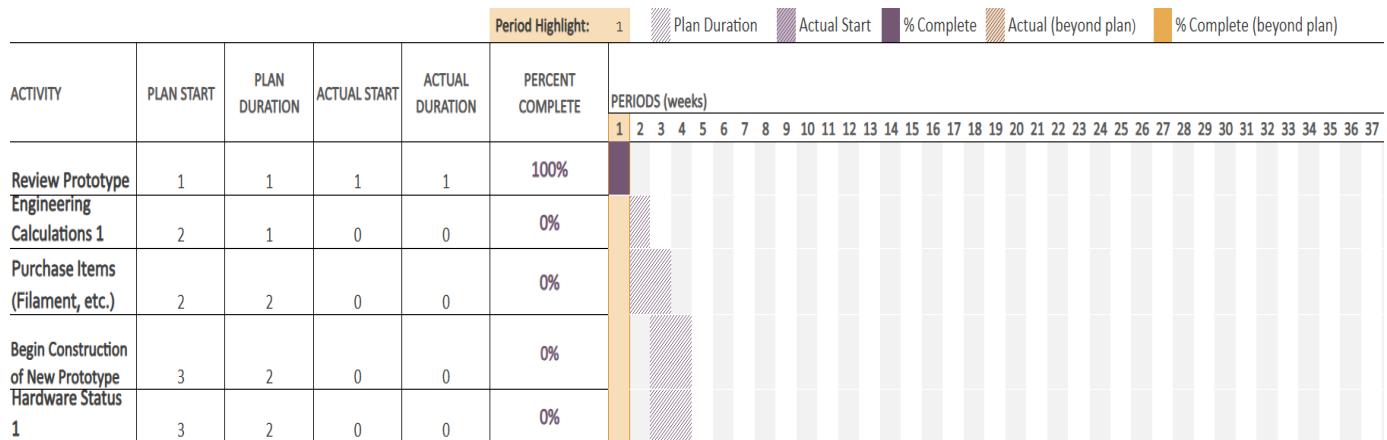
- Better work distribution on team projects so that people are having more even responsibilities in assignments.
 - **The team leader will assign specific sections to members so that one member is not doing significantly more work or significantly less work than other members. This will help spread the workload for all members so that members will not fall behind in this class or other classes**
- Create team specific deadlines prior to class deadlines to have more time to edit and better improve assignments before they need to be submitted.
 - **The group can set a deadline a day or two before the class deadline so that the team can review and edit reports and presentations rather than having to finish and edit all on the same day that it is being turned in.**

Remaining Design Efforts: This is the list of things that are left on the design aspect of the project.

- Fully Model Elbow attachment.
- Rapid prototyping and iterating of the smaller and more compact design.
 - FEA on the new motor mount design as well as bearings in the hinge.
 - Fit motors in a PLA prototype to confirm sizing.
 - Fit the plastic plate to the waist belt (Heat Forming).
 - Design for electronics/wiring.

Gantt Chart

To achieve at least a 33% on the first hardware status check, the team has made a bulleted list of what may need to be done by the date of the first status check. Below, the first four periods are shown on the Gantt chart, and the bullet list includes a description of what needs to be done within those first four weeks.



First four weeks “checklist”

- Week 1
 - Review of the new design by Colin
 - In weekly meeting go over the elbow attachment
 - Assign sub teams for the remaining components that need to be selected.
- Week 2
 - Make any possible new purchases, such as the necessary screws and bolts. Along with purchasing the carbon fiber filament to begin printing of the arm links.
- Week 3
 - Start construction of the new prototype and take note of any changes that may be needed.
- Week 4
 - Finalize Presentation and construction of the new prototype.

Top Level Finances

In the table below, the team has an estimated budget of \$4200, which includes the client's donation and the amount the team needs to fundraise. It also shows the expense of prototype 2, which was the most recent prototype. The team also plans to purchase more items for the upcoming prototype and to achieve at least a 33% build.

Incomes	
	Cost
Client	3800
Fundraising	400
Total	4200

Expenses	
Prototype 2 BoM	659.39
Final Prototype BoM Est	800

Other expenses	0
Total	1459.39

Purchasing Plan

There are items that the team has already purchased, which are marked as Purchased/Received in the table below. The items that are marked as "Not Purchased" are needed and to be ordered as soon as possible.

Bill of Materials									
Item #	Vendor	Description	Vendor #	Manufacturer	Lead Time	Quantity	Cost	Part Status	Make/Buy
1	CubeMars	AK45-36 KV80	AK45-36 KV80	N/A	N/A	2	371.8	Purchased/Received	Buy
2	Amazon	HRB 2PCS 1800mAh 6S 22.2V 50C LiPo Battery with XT60 Plug Compatible with RC Helicopter Airplane Car Boat Truck	HRB 2PCS 1800mAh 6S 22.2V 50C LiPo Battery with XT60 Plug	N/A	N/A	1	67.12	Purchased/Received	Buy
3	Sunlu	High Speed PLA 3KG Large Spool 3D Printer Filament 3KG	High Speed PLA 3KG Large Spool 3D Printer Filament 3KG	N/A	N/A	1	35.99	Purchased/Received	Buy

4	Atlas	Atlas Adventure Hiking Grade Hip Belt Black / LRG-XL 36-44"	Atlas Adventure Hiking Grade Hip Belt	N/A	N/A	1	107.74	Purchased/Received	Buy	
5	McMaster-Carr	Button Head Hex Drive Screw-Black-oxide alloy steel M3x0.50mm Thread, 8mm long	91239A113	N/A	N/A	1	8.77	Purchased/Received	Buy	
6		Button Head Hex Drive Screw-Black-oxide Class 12.9 alloy steel, M3x0.50mm Thread, 15mm long	91239A811	N/A	N/A	1	6.5	Purchased/Received	Buy	
7	Home Depot	Universal Sliding Rig Tool Belt Support	81701N20	N/A	N/A	1	34.34	Purchased/Received	Buy	
8		22 M-3x50 Screws		N/A	N/A	8	16.5	Purchased/Received	Buy	
9		PVC piping		In home	N/A	1	10.63	Purchased/Received	Buy	

10	Lerner	Circuit board	TBD	TBD	TBd	1	0	Not purchased	Buy	
11		Hinges	Metal 3D printer	Metal 3D printer		1	0	Not purchased	Make	
12	Capsone team	Brackets	Metal 3D printer	Metal 3D printer		1	0	Not purchased	Make	
13		Arm links		Lerner Lab		2	0	Not purchased	Make	
14		Motor Mounts		Lerner Lab		2	0	Not purchased	Make	
15		Sensors	TBD	TBD		TBD	0	Not purchased	Buy	
16		Elbow attachment		Lerner Lab		1	0	Not purchased	Make	
17	MarkForged	800cc Onyx Filament Spool	F-MF-0001			1	190	Not purchased	Buy	
18	MarkForged	150cc Carbon Fiber CFF Spool	F-FG-0005			1	450	Not purchased	Buy	
19	McMaster-Carr	316 Stainless Steel Flange Nut	94777A102	mcmastercarr	1 week	10	5.27	Not purchased	Buy	
20	McMaster-Carr	Button Head Hex Drive Screws	91306A776	mcmastercarr	1 week	10	6.01	Not purchased	Buy	
21	McMaster-Carr	Steel Flanged Ball Bearing, Shielded, Trade #686-2Z	57155K588	mcmastercarr	1 week	4	57.96	Not purchased	Buy	
						TOTAL COST	\$1368.63			

Manufacturing Plan

There are many parts included in our top-level design. Of these parts, some are machined, some are purchased, and some are 3D printed. Below is a list of parts, numbered according to our top-level part numbers, description, quantity, date of completion, etc.

Manufacturing Plan								
Line No.	Part No.	Sub System Name	Description	Quantity	Manufacturer / Supplier	Expected Date of Completion	Location	Mode of Manufacturing
1	R3-DET001-V1	N/A	Carbon Reinforced Nylon Arm Links	2	Lerner's Team	1/18/2026	Lerner's Lab	3D Printing
2	R3-DET002	N/A	Mount 1	1	In House	1/24/2026	ENG 108	3D Printing
3	R3-DET003	N/A	Mount 1-2	1	In House	1/24/2026	ENG 108	3D Printing
4	R3-DET004	N/A	Mount 2	1	In House	1/24/2026	ENG 108	3D Printing
5	R3-DET005	N/A	Carbon Reinforced Nylon Mount Flat Front	2	Lerner's Team	1/28/2026	Lerner's Lab	3D Printing
6	R3-DET006	N/A	Carbon Reinforced Nylon Mount Flat Rear	2	Lerner's Team	1/28/2026	Lerner's Lab	3D Printing
7	R3-SUB01-DET001	Hinge Assembly	Hinge Bracket	1	Lerner's Team	1/28/2026	Lerner's Lab	
8	R3-SUB01-DET002	Hinge Assembly	Hinge Block	1	Metal 3D Printer Capstone Team	2/6/2026	TBD	Metal 3D Printing

9	R3-SUB01-DET003	Hinge Assembly	Hinge Cam	1	Metal 3D Printer Capstone Team	2/6/2026	TBD	Metal 3D Printing
10	R3-SUB03-DET001	End Effector Assembly	Cuff Attachment	1	In House	2/16/2026	ENG 108	3D Printing
11	R3-SUB03-DET002	End Effector Assembly	Link Attachment	1	In House	2/16/2026	ENG 108	3D Printing
12	R3-SUB03-DET003	End Effector Assembly	Cuff	1	In House	2/16/2026	ENG 108	Thermo-Formed Plastic

However, in this manufacturing plan, there are some unique and special cases. Line 7 includes a specialty bracket that will be more of an acquisition rather than a manufactured part that the team deals with directly. Lines 8 and 9 leverage the special equipment of another Capstone team to manufacture. These items are included in this manufacturing plan in case there are any setbacks in these acquisitions; the team will still have this document with a plan to find alternate methods to make the parts. More than likely, the team would utilize local machine shops to help with our manufacturing needs. As of this week, the week of 01/18/26, the team is sending out parts for quotes to local shops to ensure the feasibility of acquiring these parts before critical build dates.

Conclusion

At the midpoint of this project the progress that has been achieved has been great but there is still a lot left to do over this semester. There are still several things to improve with mainly better communication needed within the team as well as to the client. Plans moving forward for the project still could change with input from the client who has been advising the team in both the purchasing and manufacturing aspects of the project. Even with all improvements that need to be made, the team is confident that they can be made and have a successful second half of the project.