Project Management Assignment – ME486C

Humanoid Hand Team

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Project Management - Success:

It feels like a successful semester that, despite setbacks, has resulted in the team being on track or ahead of schedule. Some tasks and delegations that have gone successfully for the team are:

- We have set up a group of deadlines for different parts of the project.
- We have a list of items that we planned to get done each week.
- We communicated within a timely manner on subjects related to the project and any other assignments.
- We have efficiently pivoted design aspects to implement changes and improvements our clients have asked the team to make.

Project Management – Room for Improvements and Action Items:

Every team can improve, and we feel we can improve as well. Below is a list of things we aim to improve upon:

- Equally distributing the workload among all team members.
    - **We will assign jobs for everyone to do on a weekly basis if needed and make sure everyone has their own work to do.**
- Make sure everyone stays on task on the work they were assigned.
    - **We will keep each other more updated on individual work that has been done and make sure that those who don't report are checked up on and make sure there has been progress.**
- Finish items with a due date earlier than we previously have.
    - **We will start assignments before the week of the due date, which will result in a higher quality of submitted work. Additionally, we will have time to go back and review our work to fix anything we may have missed.**

Remaining Design Efforts:

We completed most of the final prototype design last semester to be as prepared as possible for the building and testing portions of the project this semester. New methods of actuation are being researched, which may result in a redesign of some subsystems of the robotic hand (finger design, palm connection, etc.). Listed below are the planned preliminary steps for the beginning of the next phase:

- Print out and test the entire completed hand in case there are changes that need to be made.
- Complete the coding for the movement and communication of the hand.

Gantt Chart:

As a start to this semester, the next steps to take were logged into a Gantt chart:

TASK	ASSIGNED TO	PROGRESS	START	END	EST. HOURS	ACTUAL HOURS
Phase 4 (Startup of 486C)						
Project Management for 486C	Team	100%	4/1/25	5/2/25	10.00	15.00
Control systems	Team	0%	8/28/25	9/31/25	30.00	
Full print out of hand - Initial	Team	0%	8/28/25	8/30/25	20.00	
Project Management	Team	0%	8/28/25	8/30/25	10.00	
Engineeering Calculations	Team	0%	8/28/25	9/4/25	10.00	
Double check Prototype and adjust	Team	0%	8/28/25	9/31/25	30.00	
Full Print out of hand - Final	Team	0%	9/1/25	9/20/25	20.00	
Phase 5 (Building)						
Hardware Status Update - 33%	Team	0%	8/28/25	9/25/25	60.00	
Hardware Status Update - 67%	Team	0%	8/28/25	10/16/25	60.00	
Hardware Status Update - 100%	Team	0%	8/28/25	11/6/25	60.00	
Phase 6 (Collection of Stuff)						
Website Check 3	David, Markus	0%	8/28/25	10/9/25	10.00	
Finalized Testing plan	Team	0%	10/16/25	10/30/25	10.00	
Final CAD Packet	Team	0%	11/1/25	11/20/25	5.00	
Final Report & Final Website check	Team	0%	11/1/25	11/27/25	30.00	
Phase 7 (E-Fest)						
UGrads registration	Team	0%	10/23/25	10/24/25	1.00	
Draft of poster	Team	0%	10/1/25	10/30/25	15.00	
Final Poster & PPT	Team	0%	11/1/25	11/13/25	20.00	
Presentation	Team	0%	12/8/25	12/8/25	5.00	
Conclusion						
Initial Testing Results Video	Team	0%	11/6/25	11/20/25	5.00	
Product demo	Team	0%	11/6/25	11/27/25	5.00	
Client Handoff	Team	0%	12/11/25	12/11/25	1.00	
					Total Est. Hours	Total Actual Hours
					758.00	795.00

In the next month leading up to the first hardware status update, we need to complete our design structure to fit the specifications laid out by our clients. Moreover, we need to continue working on the control systems for our robotic hand to move more smoothly and

more accurately. While the control system code is being finalized, the hand can be assembled and tested to make sure the range of motion meets our goal and that every component is printed properly with our cheaper material. After the hand is built and tested, the team will move forward on the consideration of carbon fiber reinforcement depending on further durability requirements.

Top Level Finances:

	Budget sheet for Robotic Hand Capstone					
	Budget Given by Client: $1500			Fundraised Funds: $500		
	Total Budget					$2,000
	Item	Description	Do we have it?	Price per Unit	Number of Units	Total price
1	Breadboard kit	4PCS breadboard kit	Yes	$7.00	1	$7.00
2	Electronics	22 Guage silicon wire	Yes	$20.00	1	$20.00
3	Servos	DS939MG Digital Metal Servo	Yes	$9.00	4	$36.00
4	Microcontroller	PJRC Teensy 4.1	Yes	$32.00	1	$32.00
5	Bearings	Bearings	Yes	$10.00	1	$10.00
6	Motors	GM3506 Brushless Gimbal Motor	Yes	$58.53	10	$585.30
7	Potentiameter	Angle sensors	No	$1.34	20	$26.80
8	Filament	Onyx Filament	No	$209	1	$209
9	Computation	Arduino Mega	No	$49.65	1	$49.65
10	Actuation	Dyneema Cord	No	$32.99	1	$32.99
	Estimated Remaining Budget					$991.26
	Actual Remaining Budget					$1,309.70

In addition to the starting project budget of $1500, we fundraised $500 early last semester. Our subassemblies are split up into 7 different sections all costing roughly the same based on the amount of filament used. Each subassembly costs roughly $144 which can change based on the amount of 3D prints we will have to do to get each component at an acceptable quality. We have no travel expenses in our costs, nor do we have any out-of-the-ordinary costs in our project.

Purchasing Plan:

Part	Quantity	Price	Total Price	Make/Buy	Manufacturer	Lead Time	Part Status	Link
Motor								
iPower GM2804 Gimbal Motor w/ AS5048A Encoder	15	42.97	644.55	Buy	Robot Shop	2 weeks	10 in house, 5 on order	link
Servo Motor	6	8.99	53.94	Buy	Amazon	1 week	4 in house, 2 on order	link
3D Printed Parts								
PLA Prototypyng Filament	1	14.99	14.99	Buy	Amazon	1 week	on order	link
Onyx Filament	1	209.00	209.00	Buy	MatterHackers	2 weeks	on order	link
50cc Carbon Fiber Spool	1	150.00	150.00	Buy	Markforged	2 weeks	on order	link
3D Printed Fingers	4	0.00	0.00	Make	Us	10 hours	being manufactured	
3D Printed Thumb	1	0.00	0.00	Make	Us	10 hours	being manufactured	
3D Printed palm/wrist	1	0.00	0.00	Make	Us	10 hours	being manufactured	
3D printed forearm	1	0.00	0.00	Make	Us	10 hours	being manufactured	
Hardware - Computation								
Raspberry Pi	1	0.00	0.00	Buy	Raspberry Pi	2 weeks	in house	link
Teensy 4.1	2	31.50	63.00	Buy	Amazon	1 week	1 in house, 1 on order	link
Breadboard	1	6.49	6.49	Buy	Amazon	1 week	in house	link
Wire	1	19.13	19.13	Buy	Harfington	2 weeks	in house	link
Hardware - Actuation								
Dyneema Cord	1	32.99	32.99	Buy	Rocket-Fibers	2 weeks	on order	link
Bearings	25	1.05	26.25	Buy	Amazon	1 week	10 in house, 15 on order	link
Potentiometer	11	1.08	11.88	Buy	DigiKey	2 weeks	3 in house, 8 on order	link
Bowden Tube (1m/piece)	2	6.83	13.66	Buy	Amazon	1 week	on order	link
Hardware - Fasteners								
Lock Nuts (Pack of 25)	1	9.50	9.50	Buy	McMaster-Carr	2 weeks	on order	link
M3x30 Screw (Pack of 50)	1	7.85	7.85	Buy	McMaster-Carr	2 weeks	on order	link
M3x14 Screw (Pack of 50)	1	7.90	7.90	Buy	McMaster-Carr	2 weeks	on order	link
M3x8 Screw (Pack of 100)	1	8.00	8.00	Buy	McMaster-Carr	2 weeks	on order	link
M3x6 Screw (Pack of 50)	1	8.45	8.45	Buy	McMaster-Carr	2 weeks	on order	link
ESTIMATED PRICE	$		1,287.58					

As of the start of this semester, half of the parts for the hand have been ordered. We plan on finalizing the small details of our project to update the exact items and quantities we will need to order over the first few weeks. Up until this point for prototyping we have been using materials provided by the lab or by finding cheap alternatives such as fishing wire for tendons. Moving forward, we will assemble more of the hand to begin testing with higher accuracy. To assemble the rest of the hand we plan to buy the rest of our gimbal motors along with the rest of our servos which work together to actuate the hand, more filament as well as a carbon fiber spool to reinforce areas of the hand. In addition to those, we will need potentiometers, Bowden tubes to sheath the tendons, and some hardware such as screws and nuts. Not all of this will be purchased at once, but components such as more potentiometers and motors are required to move further into programming for the control of the hand. As we have ordered or borrowed a good amount of these materials from the lab, we have been able to see if the parts we want to order are the ones that we will actually want in the long run.

Manufacturing Plan:

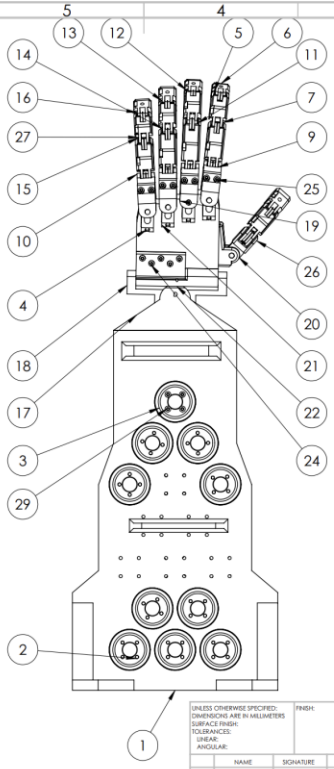
The following table is an outline of our manufacturing plan.

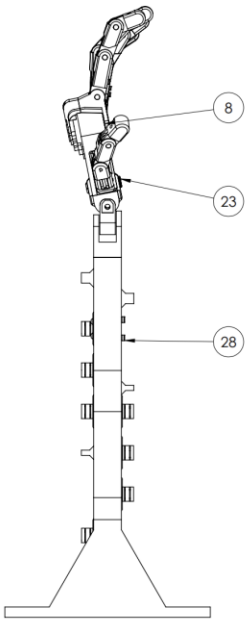
Event	***Date***	***Roles***
Semester start	8/25/2025	Everyone
Begin 3D prints	8/29/2025	Noah
Have all prints finished	9/4/2025	Noah
Begin wrist construction	9/8/2025	Markus, Tyler
Begin thumb construction	9/8/2025	David, Justin
Begin finger construction	9/8/2025	Noah
Begin forearm construction	9/8/2025	Joseph
Finish all subcomponent construction	9/24/2025	Everyone
Finish connecting all subcomponents	9/30/2025	Everyone
Have tendons attached	10/1/2025	Everyone
Begin template for thumb control	10/1/2025	David, Justin

The manufacturing plan ends early relative to the 100% build deadline. This is to allow ample time for programming, which is anticipated to take a significant amount of time. We plan to start the first building phase on the 8th of September in our previously assigned sub-teams. The plan is to have all of the sub-assemblies built by the 24th of September and take the time attaching all of these subcomponents to each other by the end of September.

All components above will be 3D printed using the Markforged Desktop and Industrial series with Onyx filament. This material was chosen due to its availability in one of the labs of our sponsors as well as its superior strength and the high dimensional accuracy of the Markforged series of printers.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	ForearmMotorHousing		1
2	Motor		16
3	motor_spindle_10mm		16
4	palm		1
5	fingMidsection		2
6	fingerTip		5
7	fingerBase		1
8	7804K106	Stainless Steel Ball Bearing	7
9	pin_2		15
10	finger_interface_bottom		4
11	fingerBase_middle		1
12	fingMidsection_middle		1
13	fingMidsection_ring		1
14	fingerBase_ring		1
15	fingerBase_pinky		1
16	fingMidsection_pinky		1
17	Wrist 2 forearm		1
18	Wrist mid		1
19	finger_interface_top		4
20	thumbbase2		1
21	servo		5
22	palm_bottom		1
23	90453A111	Low-Profile Nylon-Insert Locknuts	5
24	92095A187	Button Head Hex Drive Screw	5
25	92095A168	Button Head Hex Drive Screw	8
26	fingsplay		1
27	potentiometer		14
28	91274A102	Zinc-Flake-Coated Alloy Steel Socket Head Screw	4
29	92095A181	Button Head Hex Drive Screw	4





full_assembly

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Action items and goals in need of further planning:

1. Tendon tensioning needs addressed.
2. Wrist actuation method needs to be finalized.
3. Tendon routing needs to be shifted primarily to the top side of the palm as per sponsors' request.
4. Forearm may need to be broken into segments for printing.