

Light Dose Tensegrity Medical

Project Management for ME 486C

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1 Introduction

Tensegrity Medical is innovating a device that transforms cardiovascular health monitoring through advanced photo biomodulation (PBM) using red and infrared light-emitting diodes (LED) lights and sensors. This device promotes tissue repair, enhances cellular function and reduces inflammation, while monitoring blood flow and oxygen levels. This report provides a team reflection of the tasks and assignments completed during Capstone I, along with the project management strategy for Capstone II.

2 Reflection

The team has worked hard on completing important tasks and assignments. Our team consists of Mechanical Engineering (ME), Electrical Engineering (EE), and Computer Science (CS) students. Throughout the semester we have coordinated meeting times and delegated tasks within the team while developing the design of the device.

2.1 Project Management

2.1.1 Successes

Working with a team with completely different schedules can be difficult to arrange meetings but the team has consistently worked around this obstacle. Below is a list of successes the team had this semester.

- Coordinating meetings as a whole team
- Great communication with client/sponsor
- Good collaboration while all teams meet

2.1.2 Room for Improvements

While the team has had many successes, there are a few areas of improvement to aid in the success of the project in Capstone II. Below is a list of areas for improvement.

- Lack of communication between ME, EE, and CS
- Time management with assignments
- Meeting frequency

2.1.3 Action Items

Below is a list of action plans to aid the areas of improvement for Capstone II.

- Lack of communication between ME, EE, and CS
 1. **ME will update CS and EE on what we are currently working on. This can be biweekly or every three weeks depending on the importance of the tasks**

or assignments. Updates can be shared through Teams, text messages, or in-person meetings.

- This will give the CS and EE teams an idea of what ME is doing and gives them the opportunity to help as well.
- 2. **ME will ask CS and EE on what they are working on and if they have any updates for us. This can be biweekly or every three weeks depending on the importance of the tasks or assignments. Updates can be shared through Teams, text messages, or in-person meetings.**
 - This will prevent the ME team from being confused about what the CS and EE teams are working on. Updating each other frequently will improve communication amongst us.
- Time management with assignments
 1. **Utilize the Gantt Chart to help delegate work.**
 - This will help the team to work on assignments in different portions instead of all at once.
 2. **One of the three in ME will start tasks or format assignments to prevent working on them last minute.**
 - Sometimes formatting assignments is time consuming, so having one of us format the assignment ahead of time will significantly help. Combining this action plan with the first will improve the team's time management.
- Meeting frequency
 1. **Meet more often with EE. We can coordinate a meeting with EE once every two or three weeks. This can be in-person or virtually.**
 - Since the ME team oversees materials and the overall design of the medical device meeting with EE will help us better understand which materials and manufacturing methods would work best for the electrical components.

2.2 Remaining Design Efforts

With the collaboration of the team, there have been significant decisions in the design of the medical device. The following list is the final design efforts that still need to be completed to move along with the progress of the project.

- Chose a medical grade adhesive
- Compatibility with app that CS is developing
- Flexibility of the overall device

3 Gantt Chart

To keep track with Capstone II deliverables and deadlines, the team has created a Gantt chart to delegate tasks and manage their time effectively shown below.

TASK ID	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION IN DAYS	PCT OF TASK COMPLETE	Jan-Feb																							
							WEEK 1				WEEK 2				WEEK 3				WEEK 4				WEEK 5				WEEK 6			
							M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T	F	M	T	W	T
1	Kickoff Meetings																													
1.1	ME Team Meeting	All	01/13/25	01/14/25	2	0%																								
1.1.1	Create Meeting Agenda	TBD	01/13/25	01/13/25	1	0%																								
1.1.2	Create game plan	All	01/13/25	01/14/25	2	0%																								
1.2	Sub-team & Client Meeting	All	01/15/25	01/17/25	3	0%																								
1.2.1	Create Meeting Agenda	TBD	01/15/25	01/15/25	1	0%																								
1.2.2	Share game plan	ME Team	01/15/25	01/17/25	3	0%																								
2	Hardware Status Update (33%)																													
2.1	Circuit Wiring	ME & EE	01/20/25	02/17/25	16	0%																								
2.1.1	Meet with EE	ME & EE	01/20/25	01/24/25	5	0%																								
2.1.2	Order materials	ME Team	01/20/25	01/24/25	5	0%																								
2.1.3	Review Circuit Wiring Plan	ME & EE	01/27/25	01/31/25	5	0%																								
2.1.4	Begin wiring circuit	ME & EE	02/03/25	02/07/25	5	0%																								
2.1.5	Test on/off	All	02/07/25	02/17/25	11	0%																								

Figure 1: Capstone II Gantt Chart (Week 1 to 33% Hardware Status Update)

In the figure above is the schedule for the first six weeks of the spring semester. Around week 6 the team has their first Hardware Status Update. To reach this milestone, the ME and EE teams will be collaborating to complete the medical device’s circuit wiring in week 2 through week 6. These meetings include reviewing the schematic the EE team will provide and ordering any materials that the team needs to complete the wiring. Closer to this deadline all teams, ME, CS, and EE will meet up to ensure the device turns on and off and that it is compatible with the software that CS is providing. In week 1, kickoff meetings will take place. The goal of these meetings is to establish a plan to complete the medical device in a timely manner to leave room for testing and any adjustments it may need. This is also where the team will finalize how frequently the team will meet throughout the semester.

4 Purchasing Plan

Following the creation of our final bill of materials (BOM) we have created a plan to purchase (or print) all the parts we need to start the assembly process of our next semester’s deliverables. The BOM is included below, Table 1, to give an idea of all the parts included in our final CAD.

Table 1: Purchased BOM

#	Part Name	Part Number	Vendor	QTY	Cost Per Unit	Total Cost Per Unit	Make/Buy	Purchased	Arrived
1	Multiplexer Switch ICs	771-74HCT4067BQ,118	Mouser Electronics	10	\$1.39	\$9.15	buy	Y	N
2	Resistors (1500 pcs)	N/A	Amazon	1	\$7.99	\$7.99	buy	Y	N
3	SMD Capacitors (720 pcs)	N/A	Amazon	1	\$7.99	\$7.99	buy	Y	N
4	Red LEDs	L128-DRD1003500000	Mouser Electronics	10	\$0.44	\$4.44	buy	Y	N
5	Infrared LED	L1IG-0750100000000	Mouser Electronics	10	\$6.67	\$66.70	buy	Y	N
6	PPG Sensor	SEN0344	Mouser Electronics	1	\$15.90	\$15.90	buy	Y	N
7	IUZZAH32 - ESP32 Feather Boar	3405	Adafruit	2	\$24.50	\$49.00	buy	Y	N
8	Custom PCB	N/A	PICA Manufacturing Solutions	2	Need quote	Need quote	buy	Y	N
9	Lithium Ion Polymer Battery	LP653042	Amazon	1	\$9.99	\$9.99	buy	Y	N
10	Flexible Lithium Polymer Battery	N/A	JENAX Inc	1	Need quote	Need quote	buy	Y	N
11	TPU 95A HF	N/A	Bambu Lab	1	\$41.99	\$41.99	buy	Y	Y

The original bill of materials we created of our parts didn't include the "make/buy" section as well as the "part status" section so we had the BOM updated for this document. For all of the parts we want to use in the next prototype, we plan on buying from various vendors and once we have all of the parts quired, we will assemble them to create our final prototype. The final part in the BOM is filament that we are going to use to print the encasing for the final prototype, so although we are going to buy the filament, we are going to use it to create (make) the encasing. The only 'part' we have received is the filament (TPU) and we have already begun to experiment with printing and the possible dimensions of the encasing.

5 Manufacturing Plan

At the end of Fall semester, the team is aware of several areas on improvement in our design; thus, some design revisions are in order especially for casing component. The current manufacturing plan starting the spring semester will focus on finalizing the material selection for the casing component; this will be completed by the ME team utilizing the NAU IDEA Lab. Implementing an in-circuit system configured in series instead of parallel, completed by the EE team, and enabling Bluetooth integration with the designated app for the device, Completed by the CS team. Considering manufacturing is subjective to patient type (dog or human), lead time from start to finish is all semester, depending on testing data results and the all-team's manufacturing and collaborative skills.

6 Conclusion

Although the team has achieved significant milestones, there are still areas for improvement. Adhering to the action plan will enhance overall project management and contribute to the successful completion of key deliverables.