

2 Project Plan

2.1 PROJECT MANAGEMENT/TRACKING PROCEDURES

We are doing a hybrid project management style. There is regular interaction between us and the client and there are regular meetings. At the minimum twice a week not including class time. Because our project has many working parts, we have to meet often. But we also have a concrete schedule with milestones.

Google Drive is currently being used to track all of our progress. Everything on the app is organized into separate folders with the relevant research, information, and documents. We will add new applications when necessary.

2.2 TASK DECOMPOSITION

The main task is to create the prosthetic hand. To help make our task more clear we have separated the project into three main areas, mechanical, electrical, and software. Under each one there are multiple tasks:

Mechanical	
	Exterior Frame
	Elbow joint
	Socket/mounting
	Finger movement
	Skin/grip material
	Hand joints
	Electronic Housing
Electrical	
	Mother board design
	Power delivery/ Charging
	Flexible PCB(EMG sensors)
	Touch Sensors
	EMG Reader/Amplifier
	Electro-mechanical movement
Software	
	Signal Processing
	Touch feedback calculations
	Calibration software

2.3 PROJECT PROPOSED MILESTONES, METRICS, AND EVALUATION CRITERIA

Some of the milestones include finishing and printing the mechanical components of the prosthetic arm. We would like to accurately detect signals sent from the brain using EMG sensors to individually move fingers, but at the very least we need to get within the tolerance needed to determine a hand “on” or “off”. Realistically we would like to have less than **.1 seconds** to respond and react to a signal. We would also want the feedback from the touch sensors on the prosthetic to be within **10 milliseconds** or less. To measure progress of each task, some of them will be quantifiable but others won't be. For the ones we can measure, we can document the results on a spreadsheet for analysis. A lot of these values have not been set or cannot be fully realized at this time due to the nature of the project. A lot of this will come down to looking at waveforms on an oscilloscope or multimeter. Computer programs can be used for the analysis as well. As for the parts

of the project that can't be measured, we can only observe the functionality of the working parts and decide whether it is acceptable enough for the project.

2.4 PROJECT TIMELINE/SCHEDULE

Link to our schedule:

https://docs.google.com/spreadsheets/d/1RxnH44qIunRC1xXpaTMkU9g_izkojAdc/edit?usp=sharing&ouid=107243779695586660702&rtpof=true&sd=true

2.5 RISKS AND RISK MANAGEMENT/MITIGATION

Possible Issues	EMG sensors being unable to pick up usable data	Battery Failing(Igniting/Exploding)	Sensor data is too noisy or low quality to use for software	Feedback from touch sensor is too strong	Mechanical system for moving fingers is ineffective
Probability of Occuring	0.1	0.3	0.7	0.4	0.5
Consequence Rating	High	High	Medium	Low	High
Analysis	EMG pads are standard and are made to pick up signals. Low probability of happening.	Lithium batteries can be dangerous if compromised. It can lead to serious injury and destroy the project progress. Worst case scenario is that we separate the battery from the rest of the project.	The worst case is we would have to create an averager for our data to use a binary approach(on or off). We can also invest in a better filter or other related parts as well if needed.	This is a relatively easy fix if it occurs. But for testing, don't test it on ourselves initially.	For this problem, it may require a redesign that would be very extensive and time consuming at the worst. There have been multiple designs that have been analyzed as of rn to prevent this from happening.

2.6 PERSONNEL EFFORT REQUIREMENTS

Task	Hours Expected
Mechanical	
Exterior Frame	12
Elbow joint	TBD
Socket/mounting	10
Finger movement	14
Skin/grip material	3
Hand joints	9
Electronic Housing	2
Electrical	
Mother board design	13
Power delivery/ Charging	3
Flexable PCB(EMG sensors)	5
Touch Sensors	13
EMG Reader/Amplifier	12
Electro-mechanical movement	14
Software	
Signal Processing	12
Touch feedback calculations	15
Calibration software	17

2.7 OTHER RESOURCE REQUIREMENTS

Link to the list of parts and their prices:

https://docs.google.com/spreadsheets/d/1kXUpEGYiqC2td_-lXtdBZp3m-OvoXz_ojgmVdpfonag/edit?usp=sharing

More parts and materials will be added to this list as the project progresses.