Rowing biomechanics for lower extremities

Date: 2/22/2023

Client: Jill Thein-Nissenbaum, Tricia DeSouza
Advisor: Dr. John Puccinelli
Team:

- Team Leader: Neha Kulkarni (nnkulkarni@wisc.edu)
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Problem statement

Many college rowing athletes, particularly women, are susceptible to lifelong lower back or hip injuries due to disparate weight distributions on each leg while rowing. This issue can be addressed through gathering real-time data on athlete biomechanics, but this data is often difficult to obtain. Collection and analysis of biomechanical data will enable athletes to adapt their technique towards better performance, and will assist coaches and trainers in preventing injury. The client, Dr. Jill Thein-Nissenbaum, has tasked the team with creating a force plate system that can collect biomechanical data from rowers' lower extremities. The team's goal is to create a wireless sensor system in the rowboat that will capture load distribution during time of use and will assess lower extremity asymmetry to establish risk stratification. Additionally, the team aims to translate the force plate system into a user-friendly interface that will enable coaches and athletes to understand essential biofeedback information, thereby improving both performance and safeguarding against potential injuries.

Brief status update

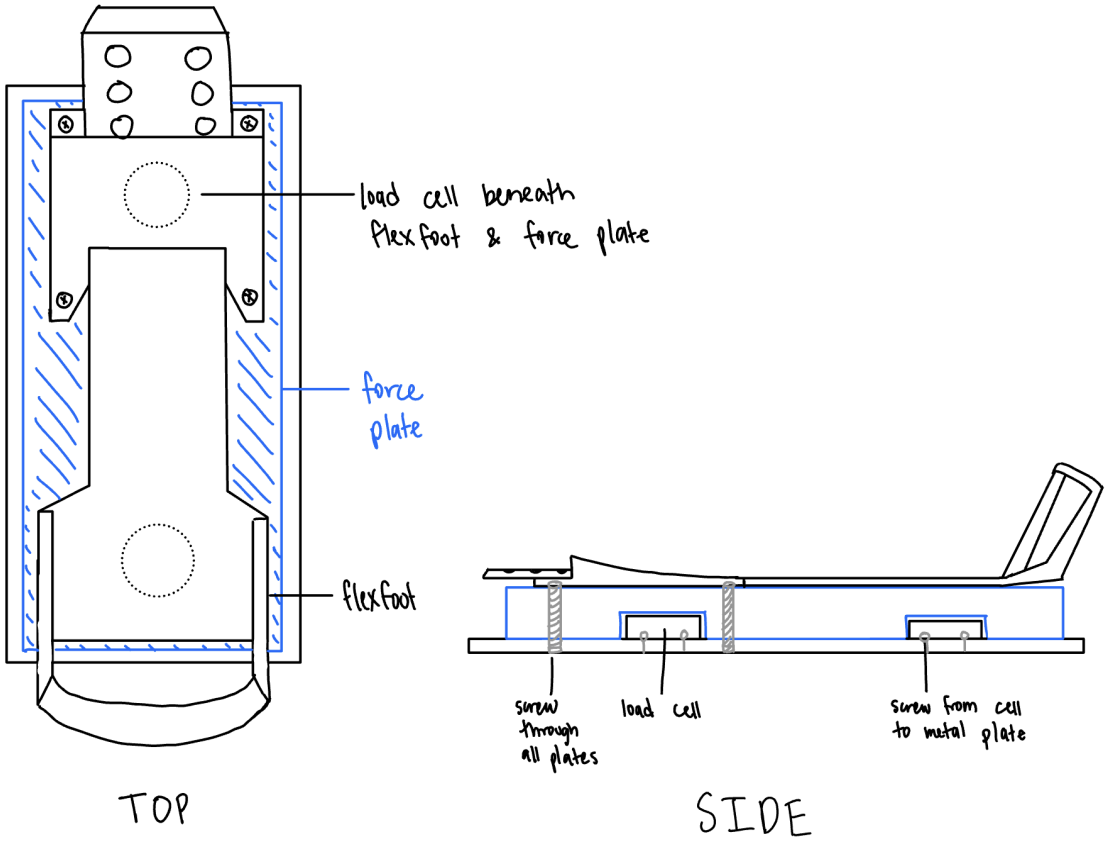
This week the team was focused on refining the preliminary designs and looking more into what materials to order as we begin prototyping. The team also consulted with a faculty member who had experience in force sensors to get his feedback on our designs.

Difficulties / advice requests

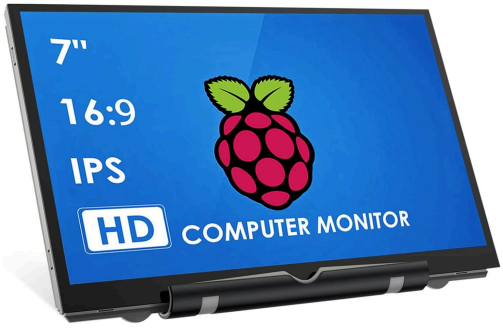
The team is still struggling to find load cells that will work for our application while still being within budget. The capacity requirements as well as the number of load cells required make the potential cost quite high.

Current design

Footplate design matrix winner: Stationary uniplate design



Display design matrix winner: Raspberry Pi + 7” LCD



Materials and expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Electronics										
Raspberry Pi	Microcontroller	Raspberry Pi		Sparkfun	DEV-15446	2/15	1	$45	$60.43	Link
									$0.00	
Raw Materials										
									$0.00	
									$0.00	
								TOTAL:	**$60.43**	

Major team goals for the next week

1. Create preliminary presentation
2. Begin preliminary report
3. Order more materials required for prototype

Next week's individual goals

- Neha
  - Order load cells that are compatible with Raspberry Pi
  - Create a fabrication plan for footplate
- Simmi
  - Research how many amplifiers can connect to Rasberry Pi along with display
  - Research softwares to connect the data to
- Allicia
  - Finalize what type of display to use.
  - Order remaining materials needed for the display.
  - Make a demonstration graphical user interface (GUI) to start working out ideas for data presentation.
- Emily
  - Create finalized prototype design
  - Complete assigned section of the preliminary presentation
- Colin
  - Complete 3D Model of Load cell housing
  - Start 3D Testing

Timeline

Task	Jan	Feb				March					April				May	
	26	2	9	16	23	1	8	15	22	29	5	12	19	26	3	10
Project R&D																
Empathize	X	X	X													
Background…	X	X	X	x												
Prototyping				x	x											
Testings																
Deliverables																
Progress Reports		x	x	x	x											
Prelim presentation																
Final Poster																
Meetings																
Client		x														
Advisor		x	x													
Website																
Update		x	x	x												

Filled boxes = projected timeline
X = task was worked on or completed

Previous week's goals and accomplishments

- Neha:
  - Researched load cell mounting methods
  - Researched materials for footplate
  - Spoke with Brandon about his idea for sensors and consulted with him on brands of load cells
- Allicia:
  - Finalized cost details on the raspberry pi and display.
  - Researched python GUI libraries and started practicing with PyQt5.
- Emily:
  - Researched raspberry pi and load cell connections
- Colin:
  - Met with Jacob Zeuske and learned important concepts about load cells
  - Started modeling the load cell housing
- Simmi:
  - Researched connections to the raspberry pi board and finalized what needs to be ordered
  - Look into LED display options

- Team previous goal: Get feedback on and refine designs
    - Learned from Jacob Zeuske about load cells

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Emily Wadzinski	2/21	Met with Jacob, asked questions	0.5	0.5	13.5
Emily Wadzinski	2/22	Researched Raspberry Pi	2	2.5	15.5
Colin Fessenden	2/21	Met with Jacob, asked questions	0.5	0.5	13.5
Colin Fessenden	2/22	SolidWorks Modeling	1	1.5	14.5
Neha Kulkarni	2/16	Researched load cell mounting methods	0.5	0.5	18.5
Neha Kulkarni	2/20	Researched footplate materials	1	1.5	19.5
Neha Kulkarni	2/22	Talked to Brandon	0.5	2	20
Allicia Moeller	2/20	Researched how to set up raspberry pi	2	2	18
Allicia Moeller	2/21	Practiced using PyQt5 with test data	4	6	22