

Asymmetrical Force Sensor for Rowing Biomechanics

Date: 2/7/2025

Client: Jill Thein-Nissenbaum, Tricia DeSouza

Advisor: David Appleyard

Team:

Team Leader: Alicia Moeller (aamoeller@wisc.edu)

Communicator: Neha Kulkarni (nnkulkarni@wisc.edu)

BWIG: Simerjot Kaur (kaur26@wisc.edu)

BSAC: Emily Wadzinski (ewadzinski@wisc.edu)

BPAG: Colin Fessenden (ckfessenden@wisc.edu)

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

Over the last two weeks the team met with their clients, advisor, and various other resources to flesh out this semester's plan. The team's proposed outline has been laid out in the preliminary presentation and begins with each teammate completing the CITI program. Once everyone is certified we will submit an IRB application for future testing. The team will then make device

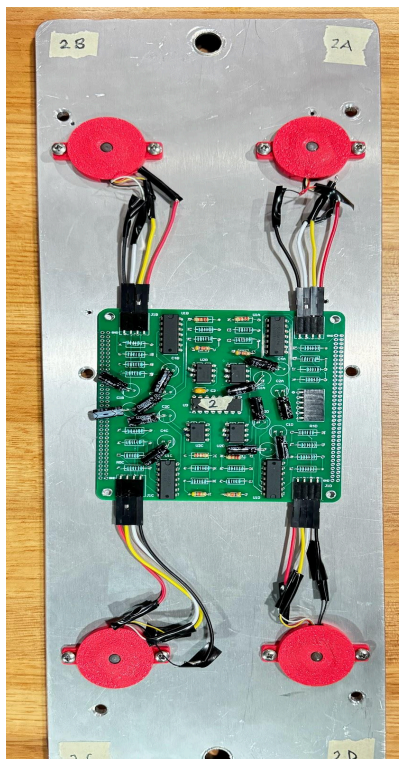
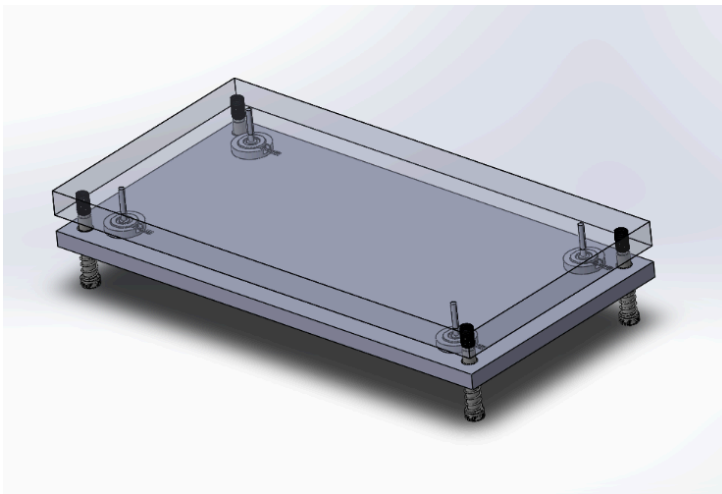
adjustments and buy reserve parts for any contingencies, followed by numerous testing procedures.

Difficulties / advice requests

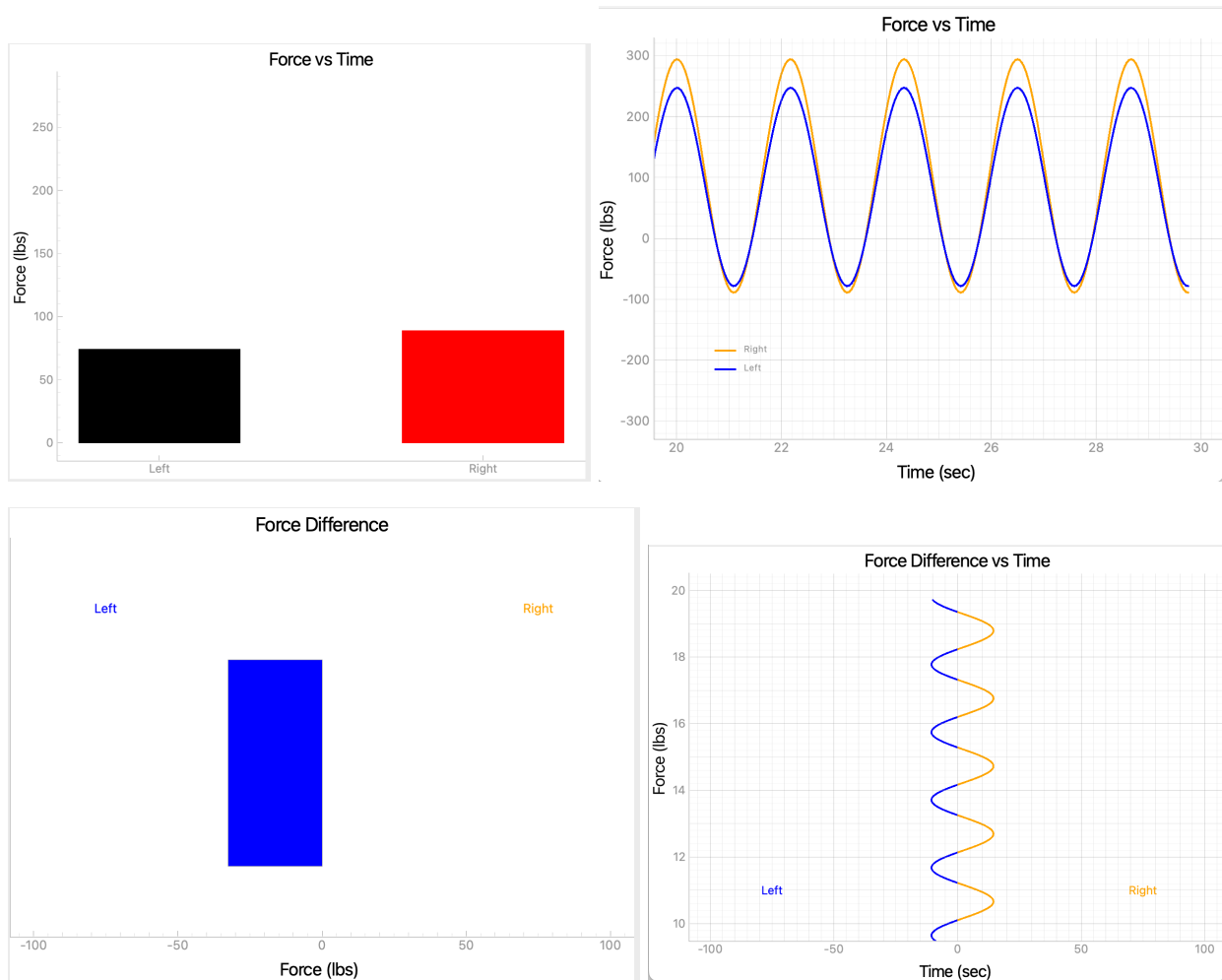
Alicia and Neha are working on submitting an IRB application with the help of Dr. Bell. The IRB needs to approve the application before any human subject testing occurs, which may take up to a month.

Current design

Stationary Force Plate



GUI (graphical user interface):



Materials and expenses (from last semester)

Description	Item #	Specs	Link	Price	Qty	Item Total
Alloy Steel Sleeve Shoulder Screw	91259A632	3/8" Shoulder Diameter	Link	\$2.86	4	\$11.44
PTFE Sleeve Bearing Shell	60695K2	3/8" OD 0.5" Length	Link	\$2.44	4	\$9.76
One End Threaded Stud	97042A145	6-32 Thread, 1" Long	Link	\$3.86	5	\$19.30
Steel Compression Springs (Pack of 5)	9434K113	0.48" OD 0.5" Length	Link	\$4.83	1	\$4.83
Dowel Pin (Pack of 5)	8381A172	1/8" Diameter	Link	\$5.92	1	\$5.92
Bronze Sleeve Bearing	6391K173	3/8" OD 0.5" Length	Link	\$1.40	1	\$1.40
T1 Connectivity Compression Load Cells	824-FX292X-100A0100L	100lb Operating Force	Link	\$28.43	8	\$227.44
12 BIT MCP3008 ADC	MCP3208-CI/P-ND	12 Bit IC ADC	Link	\$4.97	2	\$9.94
TLV274IN	296-14379-5-ND	Op Amp 4 Circuit	Link	\$1.06	10	\$10.58
1K Ohm Resistors	RNF14FTD1K00	1k ohm resistors	Link	\$0.03	100	\$3.15
Raspberry Pi Pico H	2648-SC0917-ND	microcontroller	Link	\$5	1	\$5.00
Jumper Wire	1528-1967-ND	M-M 6"	Link	\$2	2	\$3.90
10 BIT MCP3008 ADC	MCP3008-I/P-ND	10 Bit 16 DIP	Link	\$3	1	\$3.12
LM358 Amplifiers	296-1395-5-ND	8 DIP	Link	\$0	30	\$5.14

Team goals for the next week

1. Finalize IRB Submission
2. Gain familiarity with MTS Software
3. Draft CAD model of MTS Test fixture

Next week's individual goals

- Neha
 - Program a test file on the MTS and run it on some scrap rubber
 - Measure MTS dimensions for fixture
- Simmi
 - Work on cleaning up code
 - Read about design on device validity studies
- Allicia
 - Order PCBs
 - Clean up code with Simmi.
- Emily
 - Buy parts
 - Fix hole dimensions on footplate
- Colin
 - Buy parts
 - Fix CAD for plates

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																	
Background...																	
Prototyping																	
Testings																	
Deliverables																	
Progress Reports																	
Prelim presentation																	
Final Poster																	
Meetings																	
Client																	
Advisor																	
Website																	
Update																	

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

Previous week's goals and accomplishments

- Neha
 - Worked on prelim presentation
 - Filled out IRB and supplemental materials
- Simmi
 - Worked on prelim presentation
- Alicia
 - Redesigned the layout of the PCB and made a PCB for the pico.
 - Completed UW Madison's CITI course.
- Emily
 - Completed UW Madison's CITI course
 - Worked on prelim presentation
- Colin
 - Worked on prelim presentation