Rowing biomechanics for lower extremities

Date: 4/11/2023

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

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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 began working with and debugging the angular encoder. The team also ordered final prototype materials and worked on a fabrication plan and CAD model.

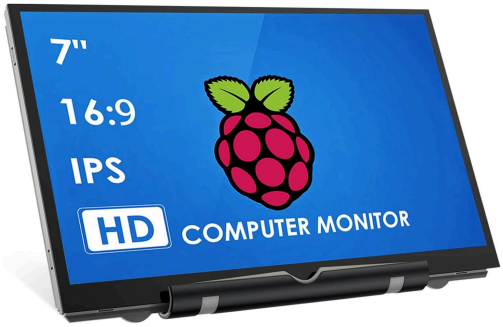
Difficulties / advice requests

This week, we have started working on connecting the angular encoder to both the Raspberry Pi and Arduino Uno. We have encountered challenges with writing code to collect the SPI output from the encoder. We were able to reach the manufacturers and get the correct datasheet, however the interface is still very complicated. We may pivot to an analog encoder and analog-to-digital converter if needed.

Current design

Prototype made for Show and Tell:

Display: 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
Raspberry Pi	7” Display Screen	Raspberry Pi		Amazon		2/23	1	$33.99	$33.99	
Raspberry Pi	20W 5V 4A Power Supply	Raspberry Pi		Amazon		2/23	1`	$11.99	$11.99	
MicroSD Card	32GB 3D NAND High Speed MicroSD Card with Adapter	Silicon Power USA		Amazon		2/23	1	$8.99	$8.99	
HDMI Cable	4K Micro HDMI to HDMI Cable 1 FT Adapter 2.0	Szsea US		Amazon		2/23	1	$8.99	$8.99	
Display Case	7” Raspberry Pi Case Holder	Longruner		Amazon		3/18	1	$13.99	$13.99	Link
Raw Materials										
Wood Scrap	TEAM Lab					3/23		$0.00	$0.00	
Aluminum Scrap	TEAM Lab					4/3		$0.00	$0.00	
								TOTAL:	**$138.38**	

Major team goals for the next week

1. Finalize angular encoder code
2. Fabricate prototype

Next week’s individual goals

- Neha
  - Assist with fabrication of prototype.
- Simmi
  - Worked on angular encoder circuit and code
- Allicia
  - Get angular encoder working.
  - Integrate angular encoder with GUI.

- Emily
    - Fabricate final prototype
    - Update lab archives
- Colin
    - Fabricate final prototype
    - Finish final prototype solidworks model

Timeline

Task	Jan	Feb					March					April				May	
	26	2	9	16	23	29	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	X	x	x	x	x		x					
Testings										x		x	x				
Deliverables																	
Progress Reports		x	x	x	x	X		x	x	x		x	x				
Prelim presentation							x										
Final Poster																	
Meetings																	
Client		x		X					x			x					
Advisor		x	x	X	X	x	x	x	x			x					
Website																	
Update		x	x	x	X	X		x	x	x		x	x				

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

Previous week's goals and accomplishments

- Neha:
    - Finalized materials for footplate
    - Dimensioned prototype
- Allicia:
    - Worked on angular encoder circuit and code.
- Emily:
    - Worked on Executive Summary
    - Completed ethical considerations with team
    - Finalized materials
- Colin:
    - Finished Executive summary
    - Finished Ethical considerations

    - Worked on final solidworks model
- Simmi:
    - Drafted angular encoder code for getting SPI output
- Team previous goal:
    - Order additional materials

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Neha Kulkarni	4/3	Materials research	3	3	34
Colin Fessenden	4/10	Executive summary and ethics	3	3	29
Colin Fessenden	4/11	Worked on final Solidworks model	4	7	36
Allicia Moeller	4/10	Angular encoder work	4	4	54
Simerjot Kaur	4/11	Angular Encoder Circuit Building	3	3	37
Emily Wadzinski	4/10	Executive summary and ethics	2	2	37