

MRI compatible motion platform

Date: 02/09/2024 – 02/15/2024

Client: Jiayi Tang

Advisor: Dr. Trevathan

Team:

Maxwell Naslund

Caspar Uy

Kendra Besser

Jamie Flogel

Amber Schneider

Problem statement

MRI phantoms used to test and calibrate MRI's are often static models of the human body. These static models don't give a good representation of the constant motion created from natural processes such as respiratory and digestive functions. To solve this, our team will work on a MR compatible device that will hold a phantom and simulate the movements found within the human body.

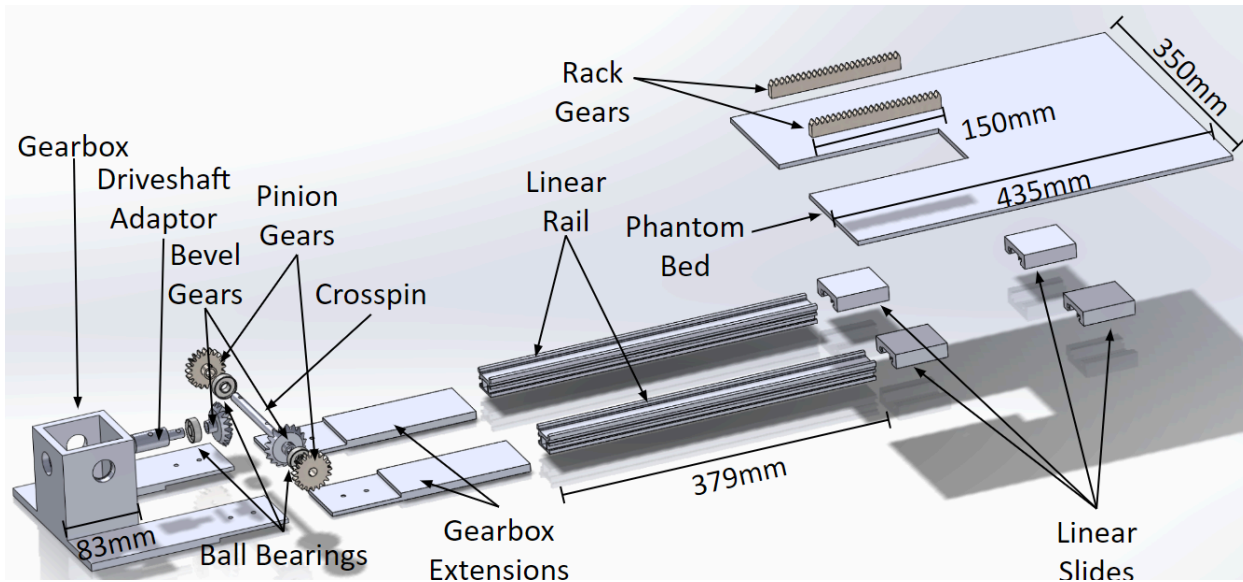
Brief status update

The team successfully prepared and presented the preliminary presentation to Dr. Trevathan. The team has spent the past week redefining semester goals and setting guidelines for progress through the semester. As the mechanical side of the project is completed in the coming weeks, the team will refocus entirely on the software side of the project, and work towards a finalized prototype.

Difficulties / advice requests

N/A

Current design



Materials and expenses

Item	Description	Manufacturer	Part Number	Date	QTY	Cost Each	Total	Link
Component 1								
Ultimaker PLA (37.0 g)	3D printed gears to translate and facilitate motion	Ultimaker	RAL-9010	10/26/2023	3	\$2.96	\$2.96	N/A
Ultimaker PLA (325.0 g)	3D printed gears and gearbox	Ultimaker	RAL-9005	11/03/2023	1	\$26.00	\$26.00	N/A
Bamboo Labs PLA (127.34 g)	3D printed gearbox extension pieces	Bambu Lab	#000000	11/15/2023	1	\$12.19	\$12.19	N/A

Ultimaker PLA (118 g)	3D printed support for the driveshaft	Ultimaker	RAL-9005	11/17/2023	1	\$9.44	\$9.44	N/A
Ultimaker PLA (27 g)	3D printed racks	Ultimaker	RAL-9005	11/29/2023	1	\$2.16	\$2.16	N/A
Ultimaker PLA (126 g)	3D printed Motor Stand	Ultimaker	RAL-9005	12/01/2023	1	\$10.08	\$10.08	N/A
Component 2								
Linear Rails	400 mm linear rails	igus	CWS-06-30-400	11/13/2023	2	\$167.69	\$335.38	Link
Component 3								
Linear Slides	Slides to support platform on linear slides	igus	WWPL-06-30-06	11/13/2023	2	\$18.25	\$36.50	Link
Component 4								
Driveshaft	Connection piece between motor and gearbox	Grainger	H0400075PW1000	11/16/2023	1	\$8.00	\$8.00	Link
Component 5								

Platform	1/4 black acrylic sheet provided by Makerspace	MSC	MSC# 63391700 (no part number given similar example)	11/17/2023	1	\$20.00	\$20.00	N/A
Component 6								
Glass Ball Bearings	Glass ball bearings to allow for frictionless rotation	Grainger	MSN0459939	12/1/2023	5	\$17.07	\$85.35	N/A
Component 7 - unused features due to reprints/redesigns								
Ultimaker PLA	3D printed Gearbox	Ultimaker	RAL-9005	10/26/2023	1	\$19.36	\$19.36	N/A
Ultimaker PLA	Motor to driveshaft adapter piece	Ultimaker	RAL-9005	12/1/2023	1	\$1.12	\$1.12	N/A
Ultimaker PLA	Motor to driveshaft adapter piece reprint	Ultimaker	RAL-9005	12/4	1	\$2.84	\$2.84	N/A
Ultimaker PLA	Motor to driveshaft adapter piece reprint	Ultimaker	RAL-9005	12/5	1	\$2.65	\$2.65	N/A
TOTAL:	\$574.03							

Major team goals for the next week

1. Continue research for the redesign and prototype improvement
 - a. Kendra and Amber - test motor code and make changes
 - b. Max, Jamie, and Caspar - Work to finalize gearbox assembly design

Next week's individual goals

- Max
 - Finalize gear optional gear ratio for gearbox assembly
 - Finalize gearbox redesign
 - 3D print gearbox redesign prototype
 - Assemble gearbox assembly using non-metallic screws.
- Amber
 - Begin implementing PID control
 - Write more motor code tests to ensure proper functionality
 - Begin researching User Interface options
 - Continue MRI certification
- Jamie
 - Finalize gear optional gear ratio for gearbox assembly
 - Finalize gearbox redesign
 - 3D print gearbox redesign prototype
 - Assemble gearbox assembly using non-metallic screws.
- Kendra
 - Perform motor code tests
 - Complete MRI certification
 - Continue to research PID control and interface options
- Caspar
 - Get the screws and potential nuts
 - Properly size the screws if needed
 - Assemble the gearbox using the non-metallic screws

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													
Background		X	X													
Prototyping			X													
Testings																
Deliverables																
Progress Reports		X	X													
Prelim presentation			X													

Final Poster																		
Meetings																		
Client		X																
Advisor	X	X	X															
Website																		
Update	X	X	X															

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

Previous week's goals and accomplishments

- Max
 - Finished preliminary design for swappable gearing for gearbox
 - Work with team to identify optimal gear ratio for gearbox
 - Helped finalize vendor for non-metallic screws
- Amber
 - Ran motor code test
 - Analyzed results
 - Updated code
 - Started MRI certification
- Jamie
 - Work with team to identify optimal gear ratio for gearbox
 - Helped finalize vendor for non-metallic screws
- Kendra
 - Began MRI safety certification
 - Communicated with client about frequency range and plastic screws order
- Caspar
 - Presented Preliminary Presentation
 - Help finalize vendor for plastic screws and nuts

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Max	1/26/24	Semester planning with team	1.5	3	10
	1/31/24	Client meeting	0.5		
	2/2/24	Team meeting to review future fabrication	1.0		
	2/2/24	Team presentation assignments	0.5		
	2/6/24	Modeled future design in solidworks	1.5		
	2/6/24	Worked on preliminary presentation	1.0		
	2/7/24	Reviewed preliminary presentation with team	1.0		
	2/12/24	Reidentified desirable producible sinusoid	1.0		
	2/14/24	Met with team to order screws, and calculate gearing ratio	2.0		
	Amber	1/26/24	Semester planning with team		

	1/31/24 2/1/24 2/2/24 2/2/24 2/5/24 2/6/24 2/7/24 2/14/24 2/15/24 2/15/24 2/15/24	Client meeting Controls research Review Motor Documentation Create preliminary presentation slides Implement changes to code Draft PID algorithm Review and practice preliminary presentation w/ team Started MRI certification Ran motor code test Analyzed results Updated code	0.5 1.0 1.0 0.5 1.0 0.5 1.0 0.50 0.50 0.50 0.50		
Jamie	1/26/24 1/31/24 1/31/24 2/2/24 2/5/24 2/6/24 2/7/24 2/8/24	Semester planning with team Client meeting Researched organ motion Worked on Preliminary presentation Completed budget slide Completed timeline slide Review and practice prelim presentation Researched Plastic Screws	1.5 0.5 0.5 0.5 0.5 1.0 1.0 0.5		6.0
Kendra	1/26/24 1/31/24 2/1/24 2/2/24 2/5/24 2/7/24	Semester planning with team Client meeting Researched transfer function Review motor documentation Edited preliminary slides Review and practice prelim presentation	1.5 0.5 0.5 1.0 0.5 1.0		5.0
Caspar	1-26-24 1-31-24 2-2-24 2-6-24 2-7-24 2-8-24 2-14-24	Semester planning with team Client Meeting Researched organ movement in MRIs Team Meeting Worked on Presentation Slides Preliminary Presentation team meeting Researched Plastic Screws Finalizing Plastic Screw and Nut Research, Met to work on gearbox	1.5 0.5 0.75 1 1.25 1 0.75 1.25	2	8.25