

BME Design-Fall 2023 - Maggie LaRose

Complete Notebook

Dynamic balance device

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SARAH RAUBENSTINE

on

Dec 13, 2023 @03:17 PM CST

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Team contact Information

ELLA LANG - Sep 08, 2023, 1:30 PM CDT

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Project description

Simon Nam - Sep 11, 2023, 5:50 PM CDT

Course Number: BME 200/300

Project Name: Dynamic Balance Device

Short Name: Dynamic Balance Device

Project description/problem statement:

Falls are the leading cause of injury-related death for those 65 and older. As a physical therapist specializing in neurological-rehabilitation one of the key intervention components is dynamic balance training. One of the tools I use to address weight shifting, reaching, visual scanning, head turns, etc. is a yard stick with a large laminated colored dot attached to the end. I need to stand with the patient for safety and the yard stick allows me to position the colored dot in various locations for reaching and visual scanning. The yard stick also allows me to vary the distance the patient must reach or turn their head.

I envision a product that isn't cobbled together from the hardware store that does the same thing with added features. Instead of a colored laminated dot, the end would be a light up disk that could be controlled by the clinician at the handle to provide various colors or even flash a number.

Our stroke patients often suffer neglect syndrome and visual scanning is key component to their recovery. The device could also be used not only for reaching, but visual scanning, all the while allowing the clinician to have a hand the patient for safety and easily varying the degree of difficulty.

About the client:

Mr. Daniel Kutschera, PT
Physical Therapy
UW Rehabilitation Hospital
kutschera@att.net
(920) 840-3937



2023/09/12 - Questions/Answers for Client Meeting #1

SHRIYA KAUSHIK - Sep 13, 2023, 6:48 PM CDT

Title: Introductory Client Meeting Questions

Date: 9/12/2023

Content by: Maggie LaRose

Present: Maggie LaRose, Shriya Kaushik, Ella Lang, Gianna Inga, Sarah Raubenstine, Simon Nam

Goals: Make introductions and ask preliminary questions about the device (prep for PDS)

Content:

Questions:

What are the initial ideas do you have?

What are some examples of the exercises you perform with these patients?

What kind of training programs should this device be employed with?

Will only therapists be handling this device?

How frequently will the device be used?

Are there any dimensional requirements for the rod (length)?

Would a fixed length or collapsible rod be preferred?

Would there be a preference for a straight vs a curved rod?

Any dimensional requirements for the light disk and/or screen to present numbers? Bigger display the better?

Do you have any preferences for specific numbers/symbols to use?

Are there any additional features (other than lights/numbers) you would like to see with this device?

Should the device have any weight restrictions?

What does your budget look like?

Should the therapist be able to adjust the length of the rod with one hand? Or is the length of the rod set before the exercises begin?

Does the therapist have a free hand during exercises for a remote for lighting or should controls be entirely on the rod handle?

What are the components and specifications of visual scanning required for dynamic balance training?

Any specific preferences for choices of the materials for producing this device?

See attachment below

Conclusions/action items:

Begin design brainstorming and continue research on neurodegenerative disorders/dynamic balance therapy/existing designs



2023/09/12 - Client Meeting #1 Notes

Title: Notes from client meeting #1**Date:** 09/12/2023**Content by:** Shriya Kaushik**Present:** All**Goals:**

- Meet the client
- Learn about the goals for the project and get questions answered about client specifications

Content:

- Current design: Yard stick and laminated dot
- 'Patients: work on static balance, and move within limits in stability, reaching left and right
- Some patients have brain injuries; they are unable to sense their left/right side
- Have the patients stand or sit, Change the colors
- Some patients have phasia, Neglect patients
- Some of these patients are walking and moving while trying to find the color dot
- Distance measurement, helpful for functional reach test
- Want: hand control, change the color, sustain the color, button control
- Needs: sanitary, wipe off when done, watertight, needs to be reused
- Static, dynamic balance, sitting, left attention, verbalizing,
- Also a cognitive device
- Colors and numbers should be able to be displayed
- target for projection: 3 inches in diameter,
- Need: lightweight for the therapist ~ around 5 lbs probably less , avoid heavy material, but should not be brittle
- 3 ft is current yardstick, max length is 3 ft.
- Could make the device retractable
- Minimum length 2 ft , max 3 ft
- Needs the device to be more professional looking
- Must be able to be stored in a central space
- Needs the control of the light/number display attached onto the rod, because one hand needs to be on the patient
- Consider: shapes , numbers for color blind patients
- Budget— \$333-1000 tbd. Probably \$333
- Meet standards of infections

Conclusions/action items:

We now have a better understanding of the project and what the client expects us to build. We will now start the PDS document and start brainstorming and ideating design ideas for our initial designs.



2023/10/04 - Client Meeting #2 Notes

Simon Nam - Oct 04, 2023, 5:23 PM CDT

Title: Notes from client meeting #1

Date: 10/04/2023

Content by: Simon Nam

Present: All

Goals:

- Meet the client
- Update on the project design and current status
- Ask further questions about the product specification and additional requirements

Content:

- Purchasing matter:

---> The client sends a check* after confirming to the finalized BPAG expense spreadsheet that contains all the list of materials needed with quantities, prices, sources of stores, etc.

-4 different types of testings done with patients specifically explained;

1. Locating the targets in various spots while standing
2. Naming the target while walking and turning head
3. identifying the color/shape of the object while visioning the target
4. functional reach test

- permission granted* to use screenshots from the demonstrated videos created by the client for the presentation

- Invitation to BME Design - Preliminary Presentations October 6th, 1:20pm for our client



2023/11/29 - Client Feedback from Prototype Use

Maggie LaRose - Dec 09, 2023, 11:23 AM CST

Title: Client Feedback from Prototype Use

Date: 11/29/2023

Content by: Maggie and Sarah

Present: Maggie and Sarah

Goals: Collect feedback from Dan after prototype use in the clinic for a week

Content:

attached below

Conclusions/action items:

Consideration for final adjustments and future work on prototype

Maggie LaRose - Dec 09, 2023, 11:23 AM CST

- Weight is too heavy
- External relief
- Larger screen
- Don't need both telescoping pieces
- Numbers in wrong order
- Auditory feedback off touch screen
- Blue, red, green, yellow, purple
- BTS screen system - competing design

Further testing

- Do a second holding test with only half extended or without battery pack

[Download](#)

11_29_-_Client_Feedback.docx (6.71 kB)



2023-09-15 - Advisor Meeting #1

SHRIYA KAUSHIK - Sep 15, 2023, 1:07 PM CDT

Title: Advisor Meeting #1

Date: 09-15-2023

Content by: Shriya Kaushik

Present: All

Goals: Debrief our client meeting and week's work with our advisor and ask clarifying questions about the project.

Content:

- Introductions with the client

- Discussed the project description and client meeting with the advisor

expectations:

communication is important in presentations and writing reports

- Next deliverable is the PDS, do lots of research of different companies, articles, etc.

Conclusions/action items:

After meeting with the advisor, we plan on continuing our research and filling out our notebook with entries of research and designs. Additionally, our goal for the next week is to work on the PDS document before our next meeting with the client.



2023-09-22 - Advisor Meeting #2

SHRIYA KAUSHIK - Sep 22, 2023, 12:46 PM CDT

Title: Advisor Meeting #2

Date: 09-22-2023

Content by: Shriya Kaushik

Present: All

Goals: Debrief our client meeting and week's work with our advisor and ask clarifying questions about the project.

Content:

- Discussed main client requirements on PDS document
- brief overview of research that team did so far: functional reach test, stroke neglect syndrome, existing devices
- discuss creation of design matrix - split up based on materials per each aspect of the device

Conclusions/action items:

After meeting with the advisor, we plan on continuing our research and filling out our notebook with entries of research and designs. Additionally, our goal for the next week is to work on the PDS document before our next meeting with the client.



2023-09-29 - Advisor Meeting #3

SHRIYA KAUSHIK - Sep 29, 2023, 1:11 PM CDT

Title: Advisor Meeting #3

Date: 09/29/2023

Content by: Shriya

Present: all

Goals: Discuss designs from design matrix

Content:

Look into having a clicker on the handle, and connect with the LCD display

Also there is a bluetooth motherboard that can be bought for \$8 - maybe can configure the clicker with bluetooth

or we can use wired connection

Conclusions/action items:



2023-10-20 Advisor Meeting #4

ELLA LANG - Oct 20, 2023, 12:57 PM CDT

Title: Advisor Meeting #4

Date: 10/20/2023

Content by: Ella Lang

Present: Everyone

Goals:

- Discuss feedback we received with our advisor
- Make a plan for the future of the project
- Discuss potential testing going forward

Content:

Feedback

- Going forward make sure we show that we looked at a variety of things besides the three we chose, essentially discuss everything we looked into and make that clear in the notebook and presentations
- Cross-reference rubric always
- Show a little bit of mechanical calculations
- She suggested that the design not be a combination of commercial designs, making it as custom as possible

Discussion of future plan

- Good to have things to prototype with
- Demonstrate that the design will fully work
- In testing, over test almost, making sure these prove that the device meets all goals and requirements
- For the first prototype, go with the random code
- Leave some of the challenges for next semester
- Move forward with the carbon fiber design soon if that is what we decide on
- If certain aspects can't be tested, have the client use it and fill out a survey

Test Ideas

- Survey for the client; comfortability to use, does it work for patients?
- battery hours calculation

Conclusions/action items:

- Contact the client about how he feels about random code idea
- Finalize testing plans and ideas
- Play around with design
- Make a decision about rod material



2023-11-10 Advisor Meeting #5

Simon Nam - Nov 10, 2023, 9:38 AM CST

Title: Advisor Meeting #5

Date: 11/10/23

Content by: team

Present: team

Goals: Update our advisor on the progress we have been making with the project and ask clarifying questions

Content:

Questions to ask advisor:

- Show her the survey questions- ask her to rate/give advice
- What kind of quantitative data do you think we can collect from this survey, and what data should we include in our final poster presentation?
- Update her on the hinge and rod process

During the Meeting:

- Update on the fabrication process;
 - talking about the electronics
 - control rod
 - measurement labels on the rod using spray painting technique
 - consultation with the Teamlab
- Planning on having the initial prototype done before Thanksgiving (Nov 18th)
- Updating on the survey questions for the client to assess the device;
 - Approval required to test the prototype with the actual patients; consult with Dan about this
 - HIPPA approval
 - Quantitative evaluation possibility
 - Health consequences, outcomes, comparisons between this device to yard stick
 - Patients being able to work better with the device's performance
 - Battery Life: Frequency of usage through the week
 - Asking healthy individuals to test the difficulty matrix of pattern recognition with multiple different combinations at different distances?
 - Testing Visibility: Brightness with different gradient levels, different sizes of shapes, symbols, etc
 - Have the scaling and options straightforward and simple for the people who fill out the survey
 - Hinge component ideas/suggestions:
 - To have a fixed 90 degrees hinge component for the attachment of the rod & electronics (Plan B, if other plans do not end up well)
 - Other alternatives: Use the selfie stick rotational bending component or bicycle circular ring adjustable attachable thing

Conclusions/action items:

Implement any appropriate changes to our design



2023-11-17 Advisor Meeting #6

ELLA LANG - Nov 17, 2023, 1:02 PM CST

Title: Advisor Meeting**Date:** 11/17/2023**Content by:** Ella Lang**Present:** All members**Goals:**

- Get advice on progress made thus far
- Ask about future testing methods
- Discuss handoff to Dan

Content:

Advice:

- Add rubber casing around 3D casing for extra protection- can be future work
- Weigh the device once done vs. that of a yardstick
- Make minor changes to the survey, make questions more specific (done)
- Add outer switch to turn on and off the battery- future work
- Ask Dan if he can ask for other therapists to use and potentially fill out the survey
- Get measurements before turning the device into the client and take photos

Discussion:

- Agreed that hinge can be future work
- Reiterated that Dan would be testing this with patients
- Test colors on friends and teammates to determine visibility
- Test at different lengths with teammates
- Use histograms of data
- Test battery life quantitatively

Concerns:

- It is hard to test because it is made up of commercial projects

Conclusions/action items:

- Reach out to Dan and prepare to meet him on Sunday with the survey ready
- Always room for improvements that we can move to future work; the advisor believes the device looks great!



2023-12-04 Advisor meeting #7

Gianna Inga - Dec 04, 2023, 1:23 PM CST

Title: Advisor Meeting

Date: 2023/12/4

Content by: Gianna

Present: Everyone

Goals: Get feedback on the poster

Content:

- break up the final design into the 3 parts of the design: electronics, 3d print, rod/alterations
- bigger text labeling the design
- too much text in the problem statement
 - Add pictures of the client showing the device
- better showcase the testing
 - results: showcase the client's feedback
 - **Add fbd of the moment**
 - make sure graphs are well-labeled and clear
- check the rubric for the poster

Conclusions/action items: We will change our poster based on the feedback from our advisor.



2023/09/25 - Rod Handle/Remote Team Meeting

Simon Nam - Sep 29, 2023, 10:51 AM CDT

Title: Rod Handle/Remote Team Meeting

Date: 2023/09/25

Content by: Gianna

Present: Gianna & Simon

Goals: Brainstorm the 3 designs and criteria for the rod handle/remote design matrix

Content:

Design 1: Remote Control Case

The Remote Control Case design utilizes the basic rectangular frame of a TV remote. Its dimensions would be 5" (L) x 2" (W) x 1" (H) and would be printed in the Formlabs Form 2 or 3. The intended material would be Formlabs Flexible 80A resin. The design would include a slot for the IR remote to be slid into if one is needed by the electronics design.

Design 2: Moldable Hand Grip

Design 2, the moldable hand grip, involves using thermoplastic beads to create a custom handle for the client. Thermoplastic beads are a material that when heated up can be molded into any shape and when cooled, hardens into a strong plastic. The handle would replicate the client's exact hand grip as its design.

Design 3: Ribbed Gym Handle

The ribbed gym handle design is inspired by the common, daily use of ribbed handles of the gym equipment for people to grab and apply force for their physical training. It is an ideal design choice for the handle with lack of slipping, capability of gripping, and further minor adjustment for the ergonomic design. This design choice can be achieved that can suit well with the other components of the device.

Conclusions/action items:



2023/10/18 - Rod and Handle Ordering

Maggie LaRose - Oct 18, 2023, 10:00 PM CDT

Title: Rod and Handle Ordering

Date: 10/18/2023

Content by: Maggie LaRose

Present: Maggie, Shriya, Gianna, Ella, Sarah, Simon

Goals: Discuss what we will be talking about during advisor meeting on Friday

Content:

- plans for moving forward how we can improve
- increase communication for the future
- cross-reference with rubric for deliverables
- encouraged to do three separate design matrices - rationale behind leaving a comment about that
- what do you think we should be doing differently, not very happy with score
- Ella filled out an online form on extendable rod website for carbon fiber rod
- rod will be minimum 1.5' and maximum 3'
- also ordered touchscreen and display things
- ask about notebook feedback as well

Conclusions/action items:

- have questions answered at advisor meeting
- work on fabrication - 3D print disk???



2023/10/25 - Task Assignment

Title: Task Assignment

Date: 2023/10/25

Content by: Gianna

Present: Gianna, Sarah, Maggie, Simon, Ella

Goals: Assign individual/team tasks, brainstorm design ideas, set timelines

Content:

Tasks:

- Measurement stickers on handle - Ella
- Gather/ work on electronics - Sarah, Maggie
- Lookup battery options/life - Simon
- Design disk - Sarah, Gianna, Shriya
 - Locking hinge(turn the display to see it)
- Arduino microcontroller - Shriya, Maggie

To Get:

- 4 AAA pack (1.5 V each) in disk
- Or Disk battery on handle (toggle switch?)
- Wires - long for button, short for connections to microcontroller
- 9V battery snap connector/battery pack
- circle battery
- Toggle switch
- Button for switching colors
- arduino uno

To Do:

- Contact dan about testing with device - set date for final prototype
 - Email dan about testing/where we are at

Deadlines:

- Deadline to have prototype done for testing: Nov 20th
- Have data from testing by dec 1st

Measurements:

- extension pole diameter(black part of the pole): 30.2mm

Shocking news:

- Simon is a DJ and has 7k followers on instagram

Conclusions/action items: Work on individual assigned tasks. We decided on the future design plans to move forward with the aluminum pole. We are brainstorming on where to place and which battery to use.



2023/11/1 - Fabrication

Gianna Inga - Nov 02, 2023, 10:27 AM CDT

Title: Fabrication

Date: 2023/11/1

Content by: Gianna

Present: Maggie, Shriya, Ella, Sarah, Simon, Gianna

Goals: Progress in each of our assigned tasks and help each other to make them better

Content:

- SolidWorks CAD drawing of the disk was created
 - intricate measurements of the display were taken and attempted to be replicated on the CAD drawing
 - basic open-back design for right now
 - thinking of a screwable lid back so the Arduino and display are accessible while also covered
- Coding was created and uploaded into the Arduino so that it displays random colors with the push of a button
- Vinyl stickers were printed for the measurements
 - when put on, they made moving the sections of the pole difficult
 - different stickers and options to display measurements are being looked at

Conclusions/action items: Going forward, we will decide which batteries to use and where to place them on the device. We will also start assembling the prototype and refining different parts. We will redesign and reprint the disk after seeing what aspects we work and need to be better.



2023/11/07- Fabrication meeting

Maggie LaRose - Nov 07, 2023, 7:53 PM CST

Title: Fabrication Meeting

Date: 11/7/2023

Content by: Maggie

Present: Maggie, Shriya, Gianna, Ella, Simon, Sarah

Goals: Figuring out plan and ordering for hinge

Content:

- will have to return current hinge - locking mechanism
- Simon - ordering selfie stick hinge or some other type of hinge - will have to modify to fit device
- Ella - different method for measurements - sticker stencil and spray paint?
- Maggie - look into soldering electronics and coding modes for shapes vs colors
- disk team - figuring out a solution for the battery pack and display backing
- Velcro battery pack on back so that can be accessed on both sides
- screw on compartment that detaches which holds battery or 4 screws
- indent for the battery pack in the backing that allows the battery pack to be flush with the back - still need magnets or Velcro to secure battery pack
- plan A - twist on/off - battery pack totally encased
- consult team lab about cutting holes in rod

Conclusions/action items:

Groups will continue fabrication plans



2023/11/03 - Show & Tell Notes

Title: Show & Tell Notes

Date: 11/03/23

Content by: Simon Nam

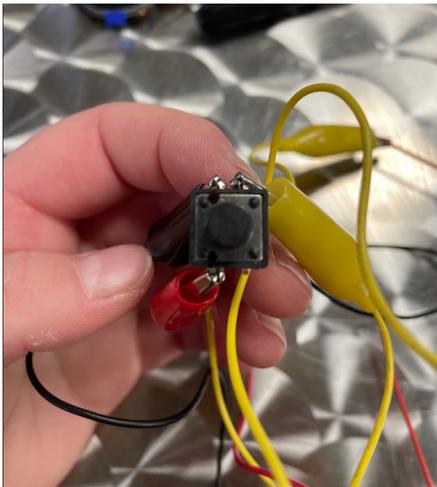
Present: All Team Members

Goals: To present the current progress of design prototype and gather ideas for arising challenges & issues

Content:

One minute 'elevator' pitch:

Hello, We are a dynamic balance device group. Our project's aim is to build up a device in order to assist the therapist who is our client at the rehabilitation center to perform reach tests with the patients with neglect stroke syndrome. We currently have the device to show a display with a touch screen that presents different colors and possibly different shapes as well which we are still working on the coding matter. We are also trying to figure out how to present the distance scales on the extendable rod in an effective manner.



'Call to action' ideas:

Questions:

We are seeking advice on better ways to attach measurements to the side of the rod that doesn't interfere with the sliders on the rod. Second, some ways to attach the battery pack to the display case such that it is easily accessible to the user. We are also looking for suggestions to make the electronics more durable in case of dropping. Also, some methods to make the device more water resistant.

- Different ways to put measurements on the side other than vinyl stickers? Interferes with collapsing method
- Ideas for attaching a battery pack to the display case? Backing with the hinge?
- How to make the electronics more durable (how to secure it to prevent any failures from physical collision in the surrounding environment)

Show & Tell Round 1:

Advice:

- Etching onto the side of the rod
- Spray paint or permanent marker
- Printer paper with sticker transfer
- Mill for a flat surface on side so laser can cut or just put stickers on side
- Larger case that encases battery
- Xbox controller???
- Attaching battery to handle
- Swiffer mop locking at angles
- Another attachment on the display that detached which holds the battery pack
- Camera stand angles

Show & Tell Round 2:

- Sanding out the small part where it contracts/retracts and has measurement labels going through more smoothly
- The disk part could be smaller in size for the weight reduction and possibly think about replacing the arduino (heavy part) near the handle & clicker
- Have a separate different 3d printing parts together and easily detachable for the battery pack to come apart easily

- Overheating issue with battery & arduino
- Counter issue to advice → Spray painting may be removed after long continuous usage?
- For solving the Hinge matter:
 - Alternative Option:
 - https://www.amazon.com/ANXRE-Portable-Wireless-Compatible-Android/dp/B0BK9P2GVR/ref=sr_1_2_sspa?crid=2NTUZED2C6KEP&keywords=selfie%2Bstick%2Bfor%2Bbiphone&qid=1699035695&srefix=selfie%2Bstick%2Bfor%2Bbiphone%2B%2Caps%2C134&sp_sponsor_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1
 - Use ^ component for adjusting rotations at different angles between electronics & the rod?
- Move the electronics part abit closer to the the center of the rod rather than at the very end due to higher moment being applied, harder for the user's wrist
- Ball socket joint method
 - To make it angle adjustable not just in one direction but also in other directions 360 degrees (3D wise) to allow more freedom of movement for the display



2023/11/17 Order Receipts for materials

Simon Nam - Nov 01, 2023, 10:46 AM CDT

10/30/23 10:52 PM Amazon.com Order ID: 114-0654328-5760241

amazon.com

Details for Order #114-0654328-5760241
[Print this page for your records.](#)

Order Placed: October 26, 2023
Amazon.com order number: 114-0654328-5760241
Order Total: \$7.37

Not Yet Shipped

Items Ordered

Item(s)	Price
1 of: QT647AK 6 Pcs 2 x 2V CR2022 Button Coin Cell Battery 600mAh with Leads On Off	\$6.99

SWIET
201801 Leasing Store ([seller profile](#))
Supplied by: Other
Condition: New

Shipping Address:
Sanghyun Nam
Amazon Hub Locker+ (UWMedison) [Stop](#)
801 W. Johnson St
Madison, WI 53706
United States

Receipt for Pick-Up:
Sanghyun Nam

Shipping Speed:
FREE Prime Delivery

Payment information

Payment Method: Visa ending in 3096	Item(s) Subtotal: \$6.99
	Shipping & Handling: \$0.00

Billing Address: Sanghyun Nam 121 S HANCOCK ST APT 5C MADISON, WI 53703-3454 United States	Total before tax: \$6.99
	Estimated tax to be collected: \$0.28

	Grand Total: \$7.37

To view the status of your order, return to [Order Summary](#).

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https://www.amazon.com/gp/checkout/review?pf_rd_p=114-0654328-5760241&pf_rd_r=114-0654328-5760241

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Amazon.com - Order_114-0654328-5760241.pdf (119 kB)

Simon Nam - Oct 20, 2023, 12:21 PM CDT

10/30/23 10:52 PM Amazon.com Order ID: 114-8939615-5591458

amazon.com

Details for Order #114-8939615-5591458
[Print this page for your records.](#)

Order Placed: October 18, 2023
Amazon.com order number: 114-8939615-5591458
Order Total: \$16.85

Not Yet Shipped

Items Ordered

Item(s)	Price
1 of: 1.5-3 ft Long Paint Roller Extension Pole // Multi-Purpose Telescopic Extension Pole with Universal Fasten Hook Zip // Lightweight & Sturdy, Adjustable Pole for Painting, Dusting and Window Cleaning	\$15.97

SWIET
201801 Leasing Store ([seller profile](#))
Supplied by: Other
Condition: New

Shipping Address:
Sanghyun Nam
121 S HANCOCK ST APT 5C
MADISON, WI 53703-3454
United States

Shipping Speed:
FREE Prime Delivery

Payment information

Payment Method: Visa ending in 3096	Item(s) Subtotal: \$15.97
	Shipping & Handling: \$0.00

Billing Address: Sanghyun Nam 121 S HANCOCK ST APT 5C MADISON, WI 53703-3454 United States	Total before tax: \$15.97
	Estimated tax to be collected: \$0.88

	Grand Total: \$16.85

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https://www.amazon.com/gp/checkout/review?pf_rd_p=114-8939615-5591458&pf_rd_r=114-8939615-5591458

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Amazon.com - Order_114-8939615-5591458.pdf (117 kB)


```

-double--center-UW Makerspace
*****
Date: 11/01/2023    Time: 17:09
Transaction #: 2463
Register Name: Makerspace 2
*****
Sale
Batteries                1.15T
-----
Subtotal                  1.15
Tax                       0.06
Total                     1.21

Credit
XXXXXXXXXXXX3738        1.21
Visa
NAM SANGHYUN
Approval 095013

```

```

*****
Make Good Things!
*****

```

[Download](#)

UW_Makerspace_Battery_1_.pdf (174 kB)

```

-double--center-UW Makerspace
*****
Date: 11/01/2023    Time: 18:55
Transaction #: 2472
Register Name: Makerspace 2
*****
Sale
PLA                        3.44
-----
Subtotal                  3.44
Tax                       0.00
Total                     3.44

Credit
XXXXXXXXXXXX3738        3.44
Visa
NAM SANGHYUN
Approval 050745

```

```

*****

```

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3D_Printing_receipt_1.pdf (207 kB)

08/02/18 02:04 AM Amazon.com Order ID: 2878938-7061036
amazon.com
Details for Order #114-2878938-7061036
[Print this page for your records.](#)

Order Placed: November 5, 2023
Amazon.com order number: 114-2878938-7061036
Order Total: \$12.65

Not Yet Shipped

Items Ordered	Price
1 of: axxon® Foam Tubing for Handle Grip Support, Pipe Insulation, 30mm ID 40mm OD <small>10m Length (black) SKU: B-0001 (color: black) Product question? Ask seller Supplier: Other</small>	\$11.99

Shipping Address:
Sanghyun Nam
121 S HANCOCK ST APT 3C
MADISON, WI 53703-3454
United States

Shipping Speed:
FREE Prime Delivery

Payment information

Payment Method: Visa ending in 3096	Item(s) Subtotal: \$11.99 Shipping & Handling: \$0.00
Billing address: Sanghyun Nam 121 S HANCOCK ST APT 3C MADISON, WI 53703-3454 United States	Total before tax: \$11.99 Estimated tax to be collected: \$0.66
	Grand Total: \$12.65

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Amazon.com - Order_114-2878938-7061036.pdf (118 kB)

-double--center-UW Makerspace

Date: 11/10/2023 Time: 13:18
Transaction #: 2665
Register Name: Makerspace 2

Sale	
Cables	0.807
<hr/>	
Subtotal	0.80
Tax	0.04
Total	0.84
Credit	
XXXXXXXXXXXX3738	0.84
Visa	
NAM SANGHYUN	
Approval 082348	

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Makerspace_order.pdf (196 kB)

03/23 1:49 PM Amazon.com Order 112-1403659-3901065

amazon.com

Details for Order #112-1403659-3901065
[Visit this page for your account.](#)

Order Placed: November 10, 2023
Amazon.com order number: 112-1403659-3901065
Order Total: \$18.98

Preparing for Shipment

Items Ordered	Price
1 of: Soldering Iron Kit - Soldering Iron 60W Adjustable Temperature, Solder Wire, Soldering Station, Wire Cutter, Solder Tips, Desoldering Pump, Tweezers, Solder Paste, Antistatic Tubes from Amazon	\$17.99
Sold by: Amazon (amazon.com)	
Shipped by: Other	
Condition: New	

Shipping Address:
 Sanghyun Nam
 121 S HANCOCK ST APT 5C
 WAUWATON, WI 53783-3454
 United States

Shipping Speed:
 FREE Prime Delivery

Payment information

Payment Method: Visa ending in 2096	Item(s) Subtotal: \$17.99
	Shipping & Handling: \$0.00

Billing address: Sanghyun Nam 121 S HANCOCK ST APT 5C WAUWATON, WI 53783-3454 United States	Total before tax: \$17.99
	Estimated tax to be collected: \$0.99

	Grand Total: \$18.98

To view the status of your order, return to [Order Summary](#).

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Amazon.com - Order_112-1403659-3901065.pdf (115 kB)

-double--center--UW Makerspace

 Date: 11/16/2023 Time: 18:16
 Transaction #: 76
 Register Name: Makerspace 2

Sale	
PLA	7.84

Subtotal	7.84
Tax	0.00
Total	7.84
Credit	
XXXXXXXXXXXX3738	7.84
Visa	
CARDHOLDER/VISA	
Approval 065315	
***** EMV PURCHASE *****	
App Label:	VISA DEBIT
Mode:	Issuer
AID: A0000000031010	
TVR: 000000000	
IAD: 06011203A00000	
TSI:	
APP: 00	

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Adobe_Scan_2023_11_17..pdf (233 kB)



2023-10-25 Hinge between rod and disk

SHRIYA KAUSHIK - Nov 01, 2023, 6:52 PM CDT

Title: Hinge between rod and disk

Date: 10/25/2023

Content by: Shriya Kaushik

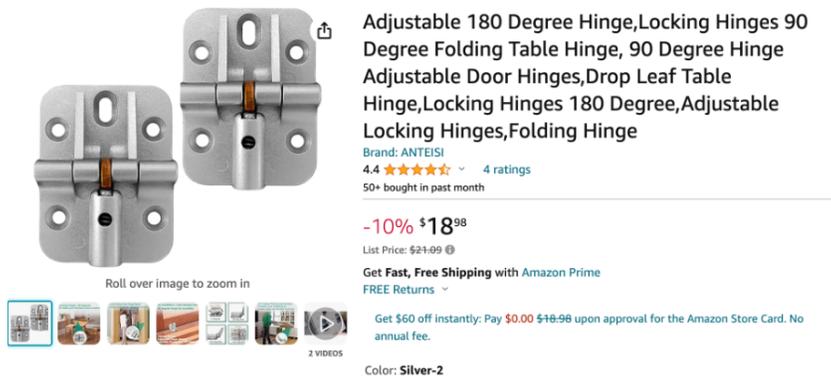
Present: n/a

Goals: Figure out if the hinge is something we can incorporate into the design.

Content:

Using this hinge would allow the therapist to adjust the angle and lock in the angle to show the patient the disk. This specific hinge is from Amazon and costs \$19. It would definitely help with rigidity, and holding the rod and the disk securely. Ideally, we would drill two holes into the rod on one panel, and on the other panel we would drill two holes into the Solidworks Disk.

Amazon Link: https://www.amazon.com/Adjustable-Locking-Folding-Bi-Fold-Cabinetsand/dp/B0BX26VLH4/ref=sr_1_17?crid=1MHP5A0LN3LCS&keywords=adjustable%2Bhinges&qid=1698278562&prefix=adjustable%2Bhinges%2Caps%2C94&sr=8-17&th=1



Benefits:

- The hinge can lock in multiple positions and different angles: 0°, 90°, 135°, and 180°.
- This provides variety for the therapist to adjust positioning of display to test the patients' vision and balance ability.

Conclusions/action items:

Discuss with team to see if implementation is possible. Order and make a plan to start fabricating once 3d printed Disk is ready.



2023-11-1 SolidWorks Disk Design #1

SHRIYA KAUSHIK - Nov 01, 2023, 6:51 PM CDT

Title: SolidWorks Design for Disk

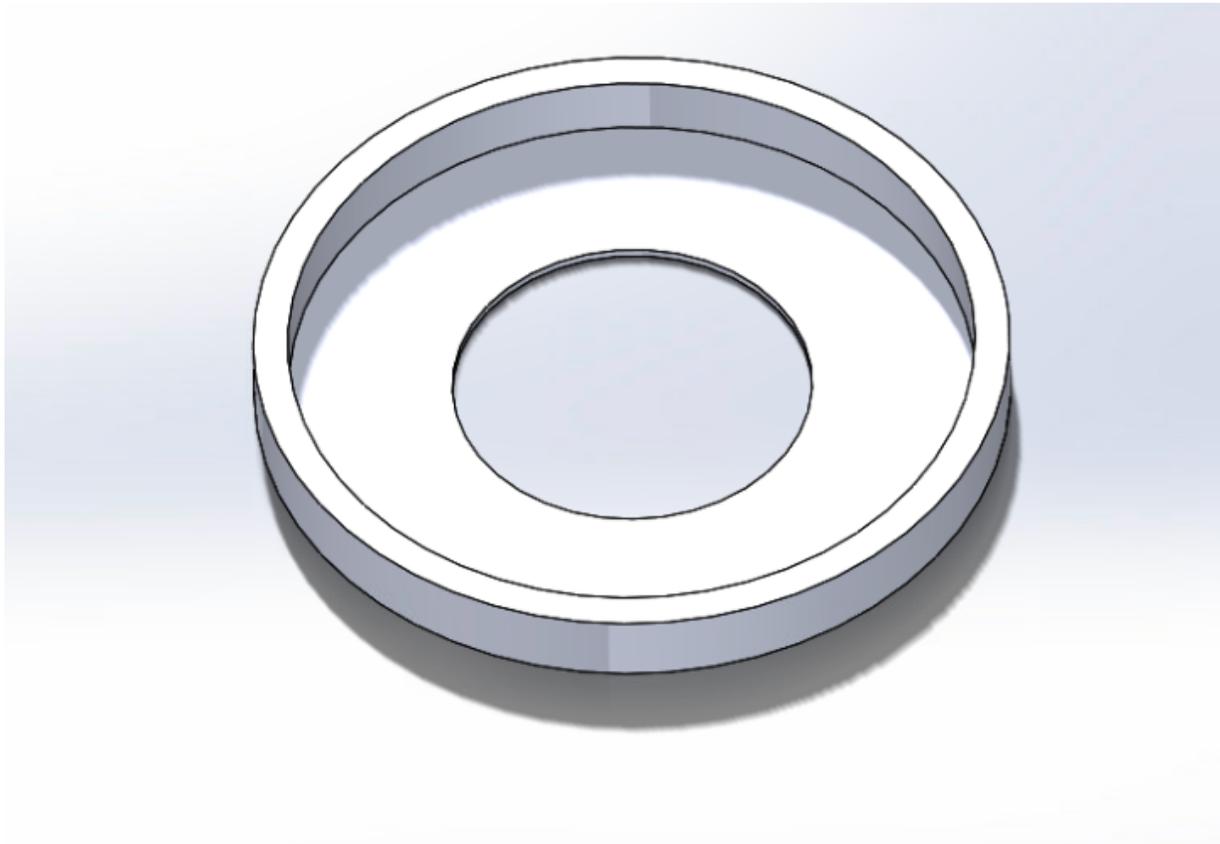
Date: 11-1-2023

Content by: Shriya Kaushik

Present: n/a

Goals: Come up with a design on solidworks for the Disk

Content:



Outer diameter: 4 in

Middle diameter: 3.7 in

Inner diameter: 1.6 in

Outer height: 0.80 in

inner height: 0.1 in

Conclusions/action items:

3D print the final SolidWorks design at the makerspace.



2023/11/15 - Arduino code - colors dice roll

Title: LCD Arduino Code - Color Dice Roller**Date:** 11/15/2023**Content by:** Maggie LaRose**Present:** Maggie LaRose**Goals:** Write code for screen to paint random color with click of button**Content:**

```
#include <SPI.h>
#include "LCD_Driver.h"
#include "GUI_Paint.h"
#include "image.h"

void setup(){

  Config_Init();
  LCD_Init();
  LCD_SetBacklight(1000);
  Paint_NewImage(LCD_WIDTH, LCD_HEIGHT, 0, BLACK);
  Paint_Clear(BLACK);
  Paint_DrawString_EN(50, 120, "Click to Begin", &Font16, WHITE, WHITE);
  Paint_DrawString_EN(120, 140, ":)", &Font16, WHITE, WHITE);

  const int button = 2;
  pinMode(button, INPUT);

  randomSeed(analogRead(0));

}

void loop(){

  if (digitalRead(2) == HIGH){
    int result = rollDice();
    if(result == 1){
      Paint_Clear(RED);
    }
    if(result == 2){
      Paint_Clear(YELLOW);
    }
    if(result == 3){
      Paint_Clear(GREEN);
    }
    if(result == 4){
      Paint_Clear(BLUE);
    }
    if(result == 5){
      Paint_Clear(MAGENTA);
    }
    if(result == 6){
      Paint_Clear(GBLUE);
    }
    delay(1000);
  }
}

int rollDice(){
  return random(1, 7);
}
```

Conclusions/action items:

Develop random shapes program, try to use different colors



2023/11/17 - Prototype Fabrication Progress

Title: Prototype Fabrication Progress

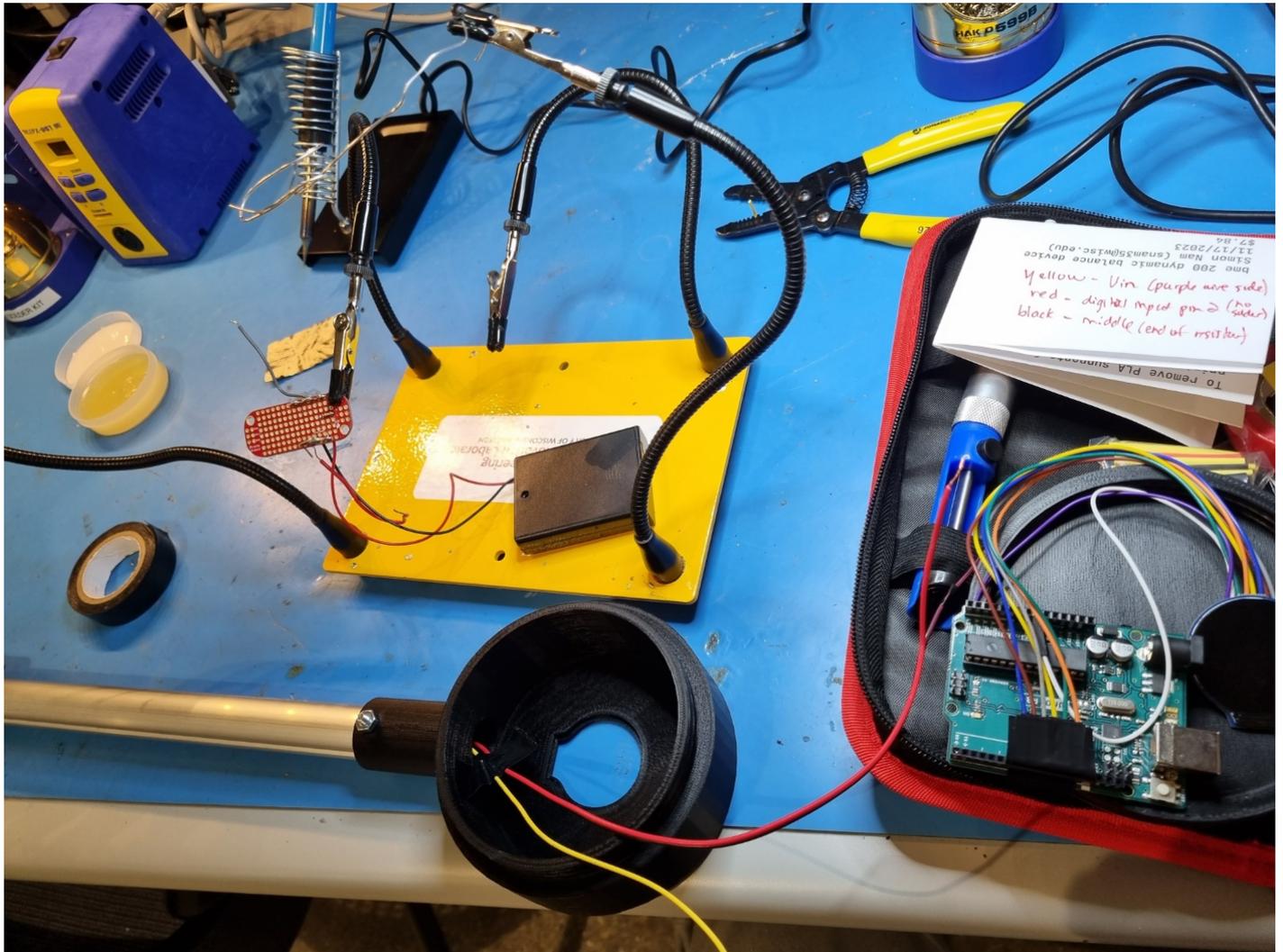
Date: 11/17/23

Content by: Simon

Present: N/A

Goals: To establish the soldering for wires and assemble parts together

Content:





Conclusions/action items: N/A



2023/11/29 - Laser Etch Measurements File

Maggie LaRose - Dec 09, 2023, 11:31 AM CST

Title: Laser Etch File

Date: 11/29/2023

Content by: Ella Lang

Present: Ella and Maggie

Goals: Import laser etch file

Content:

attached below

Conclusions/action items:

Laser etch measurements into side of rod

Maggie LaRose - Dec 09, 2023, 11:30 AM CST



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Dynamic_Balance_Device_-_Laser_Etch.ai (1.22 MB)



2023/12/9 - Final Electronics Schematic

Maggie LaRose - Dec 09, 2023, 11:10 AM CST

Title: Final Electronics Schematic

Date: 12/9/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Import final electronics schematic

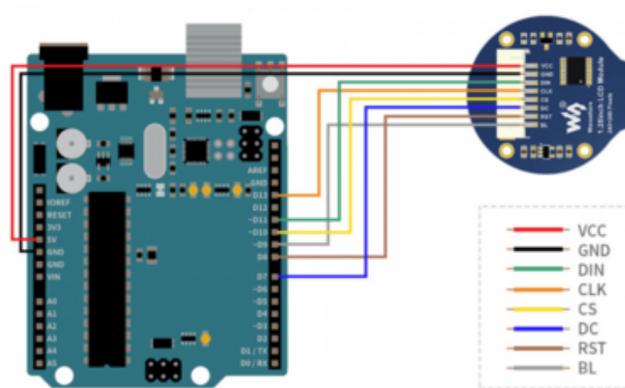
Content:

Attached below

Conclusions/action items:

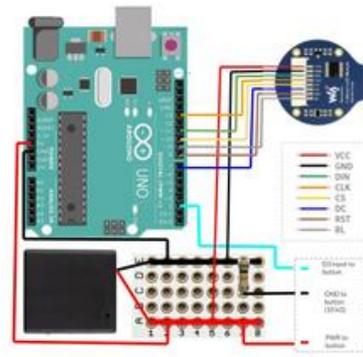
Use on poster

Maggie LaRose - Dec 09, 2023, 11:10 AM CST



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Screenshot_2023-12-03_180735.png (464 kB)



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Electronics_Schematic.jpg (50.4 kB)



2023/12/9 - Disk Electronics Fabrication

Maggie LaRose - Dec 09, 2023, 11:08 AM CST

Title: Disk Electronics Fabrication

Date: 12/9/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Import images of electronics fabrication

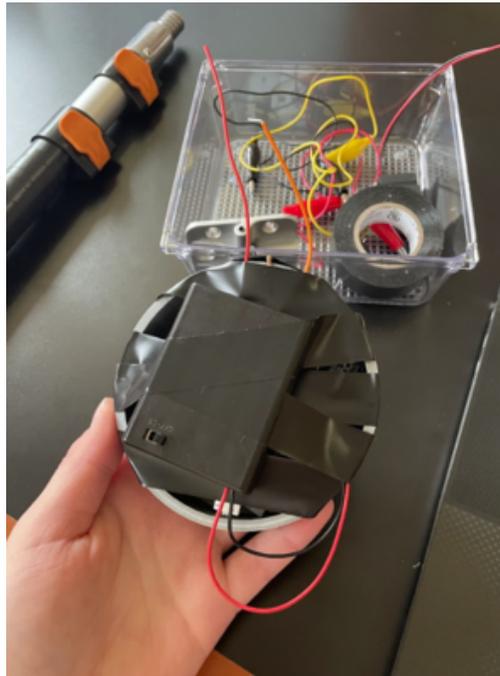
Content:

Attached below

Conclusions/action items:

Options for poster

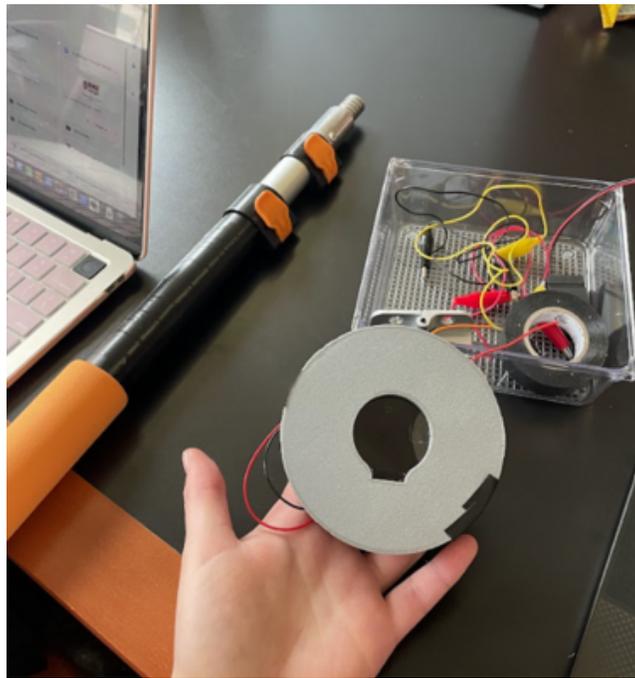
Maggie LaRose - Dec 09, 2023, 11:09 AM CST



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Screenshot_2023-11-03_115253.png (748 kB)

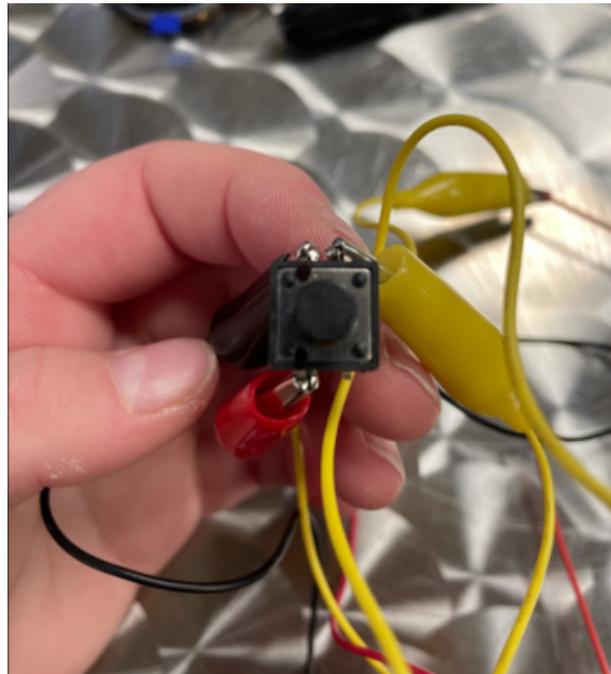
Maggie LaRose - Dec 09, 2023, 11:09 AM CST



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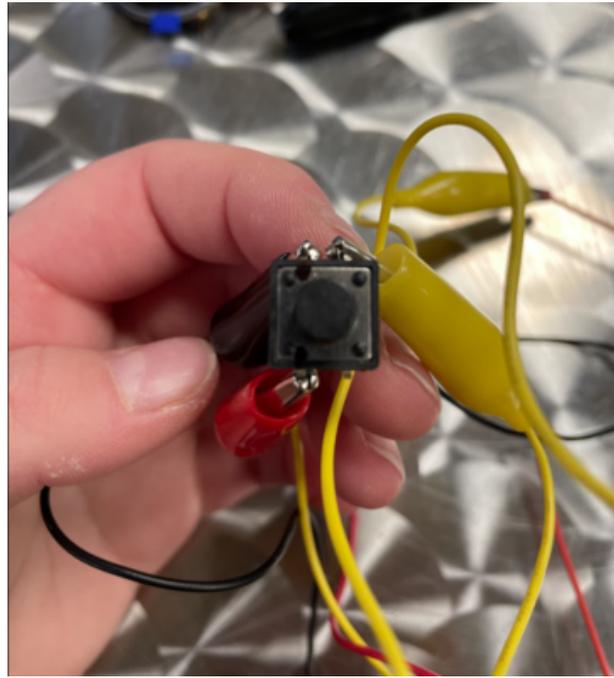
Screenshot_2023-11-03_115342.png (592 kB)

Maggie LaRose - Dec 09, 2023, 11:09 AM CST



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Screenshot_2023-11-03_120547.png (627 kB)



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Screenshot_2023-11-03_120547.png (627 kB)



2023/12/9 - Final Prototype Images

Maggie LaRose - Dec 09, 2023, 11:05 AM CST

Title: Final Prototype Images

Date: 12/9/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Import final prototype images

Content:

Attached below

Conclusions/action items:

Use on poster

Maggie LaRose - Dec 09, 2023, 11:06 AM CST



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Screenshot_2023-12-03_210354.png (1.29 MB)

Maggie LaRose - Dec 09, 2023, 11:06 AM CST



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Screenshot_2023-12-03_210426.png (575 kB)

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Screenshot_2023-12-03_210444.png (807 kB)

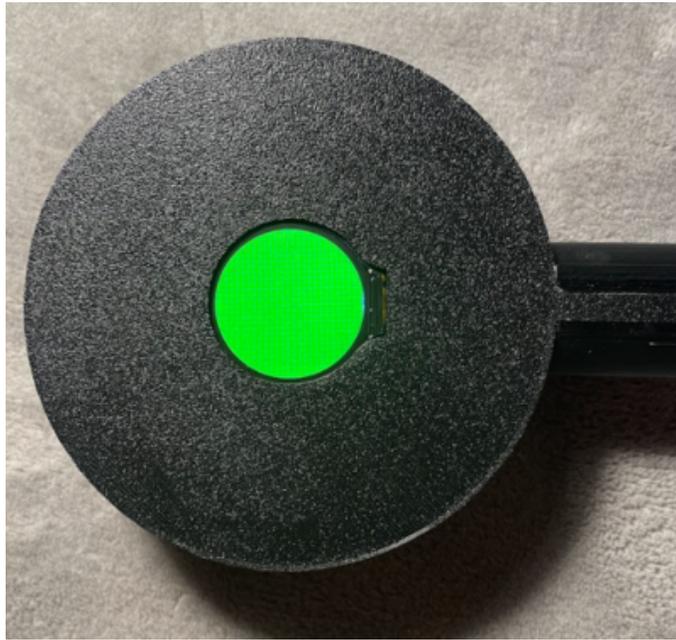
Maggie LaRose - Dec 09, 2023, 11:06 AM CST



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Screenshot_2023-12-03_210502.png (576 kB)

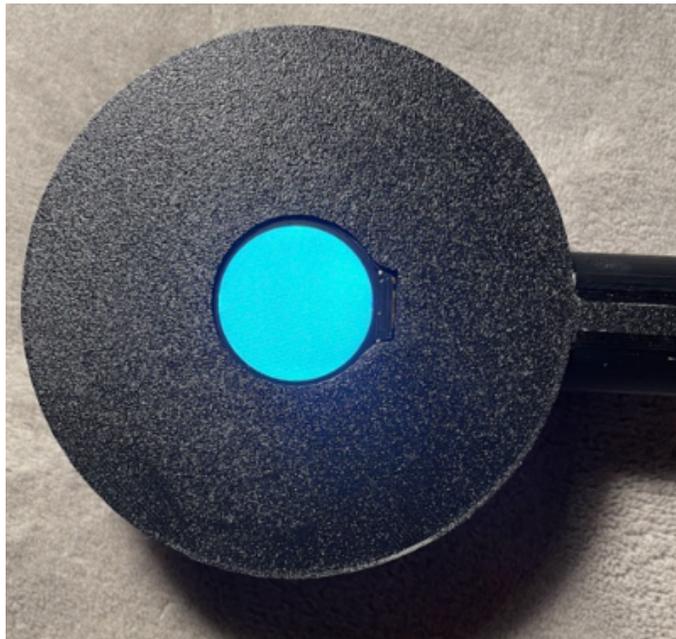
Maggie LaRose - Dec 09, 2023, 11:06 AM CST



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Screenshot_2023-12-03_210515.png (528 kB)

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Screenshot_2023-12-03_210531.png (581 kB)

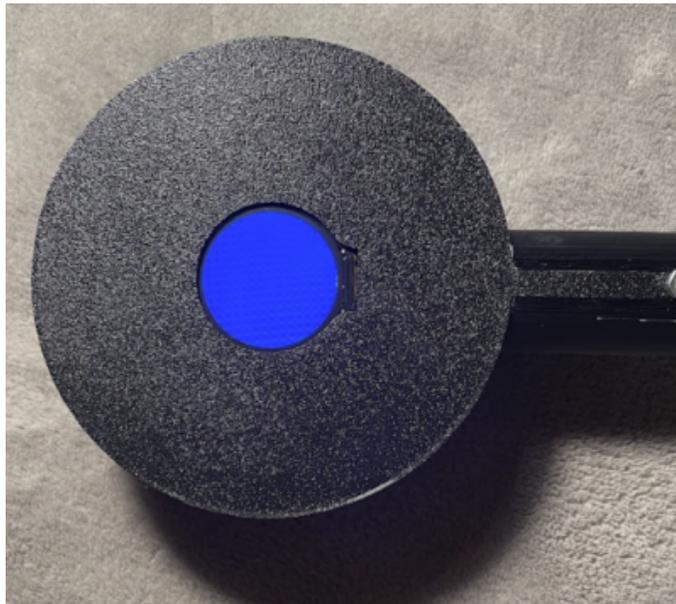
Maggie LaRose - Dec 09, 2023, 11:06 AM CST



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Screenshot_2023-12-03_210545.png (524 kB)

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Screenshot_2023-12-03_210608.png (547 kB)

Maggie LaRose - Dec 09, 2023, 11:06 AM CST



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Screenshot_2023-12-04_102536.png (605 kB)



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Final_prototype_2_.jpg (41.8 kB)



2023/12/12 - Disk SolidWorks Fabrication

Title: Disk SolidWorks Drawing

Date: 2023/12/12

Content by: Gianna

Present: Gianna

Goals: Document the SolidWorks process of creating the disk container

Content:

1. Measure Arduino microcontroller, battery pack, LCD touchscreen
2. Create SolidWorks part: Disk
3. Create a sketch with
 1. 3 circles centered on the origin with radii: 2.25", 1.85", .7005"
 2. A .5725" vertical line .8155" from the right plane
 3. Tangent Arc connecting the edges of the line to the smallest circle
4. Boss Extrude the base excluding the smallest circle and the area created by the tangent arc and line 1.8"
5. Cut extrude the middle circle 1.65"
6. Create a sketch on the bottom of the inside of the cylinder and outline the smallest circle, tangent arcs, and line segment by .05"
7. Cut extrude the sketch .085"
8. Create a sketch on the top edge of the cylinder and create a circle centered on the origin with a 2" radius
9. Cut extrude the area between the 2" circle and the outer edge of the cylinder .5"
10. Add right-handed threads to the cut extruded edge of the cylinder with the following details:
 1. Cut thread
 2. Type: Inch Die
 3. Size: #10-24
11. Create a hole with hole wizard on the side of the cylinder
 1. Position the center of the hole 1.2" from the front plane
 2. Size: 1/16
 3. Diameter: .75 in
12. Create a plane 4" from the right plane
13. Create two circles centered on the side cylinder hole on the new plane with radii: .47", .6"
14. Boss Extrude the area between the circles up to the surface of the cylinder
15. Create a vertical hole with hole wizard on the new extruded part
 1. Positioned .25" from the created plane
 2. Size: #97
 3. Diameter: .1875"
 4. Extrude through both sides

16. Create a new SolidWorks part: Lid
17. Create a sketch with a circle centered at the origin with a 2.25" radius
18. Boss Extrude the circle .65"
19. Create a sketch on the circle flat edge with a circle centered on the origin with a 2.025" radius
20. Cut Extrude the circle .5"
21. Add right-handed threads to the inner edge of the lid with the following details:
 1. Extrude Thread
 2. Type: Inch Die
 3. Size: #10-24

Conclusions/action items: Use this instruction to create the SolidWorks drawing of the dynamic balance device disk and lid.

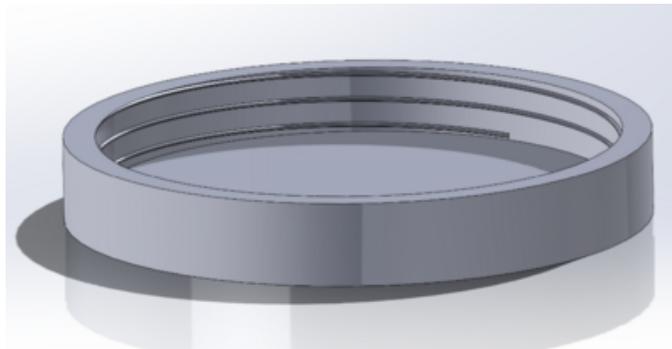
Gianna Inga - Dec 12, 2023, 6:33 PM CST



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1disk.SLDPRT (323 kB)

Gianna Inga - Dec 12, 2023, 6:35 PM CST



[Download](#)

disk_lid.SLDPRT (302 kB)



2023/11/15 - LCD Visibility Testing Protocol

Maggie LaRose - Dec 09, 2023, 11:01 AM CST

Title: LCD Visibility Testing (on healthy subjects) Protocol

Date: 11/15/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Testing for LCD Visibility

Content:

1. Begin with screen displaying the red color and set the screen 5' away from the subject
2. Have each team member identify colors for 10 trials and record accuracy per color.
3. Repeat process for distances of 10', 15', 20'
4. At 20' distance, record reaction time per color

Conclusions/action items:

Perform test and create visibility matrix, average accuracy per color, and average reaction time per color





2023/11/19 - Holding Testing Protocol and Pictures

Title: Holding Testing

Date: 11/19/2023

Content by: Maggie LaRose

Present: Maggie, Shriya, Gianna, Simon, Ella, Sarah

Goals: Perform Holding testing of device

Content:

Procedure:

1. Hold device with dominant arm 180 degrees
2. Record time it takes to feel: 1. uncomfortable and 2. unable to hold up anymore
3. Repeat process with non-dominant arm





Conclusions/action items:

Perform test with varying counterweights



2023/12/3 - Counterweight testing

Title: Counterweight testing protocol**Date:** 12/3/2023**Content by:** Maggie LaRose**Present:** Shriya, Maggie, Ella, Simon, Gianna, Sarah**Goals:** Perform counterweight testing**Content:**

4 Scenarios:

1. Fully extended normal
2. Fully extended moved battery
- 3. Half Extended normal**
4. half extended moved battery

Half Extended Normal Protocol:

1. Have each team member hold the half extended rod with no counterweight attached and rate pain on a scale from 1-5.
2. Attach 1.07 kg counterweight to the end of the handle
3. Have each team member hold the rod and rate pain on a scale from 1-5.
4. Repeat process for counterweights of 0.535 kg, 0.268 kg, and 0.134 kg.

Record data and make polynomial type fit curve. Derive minimum for ideal counterweight.



Conclusions/action items:

Collect counterweight testing data - make function for counterweight and reaction moment



2023/11/15 - LCD Visibility Testing Data

Maggie LaRose - Dec 09, 2023, 11:26 AM CST

Title: LCD Screen Visibility Testing Data

Date: 12/9/2023

Content by: Maggie, Shriya, Ella, Gianna, Simon, Sarah

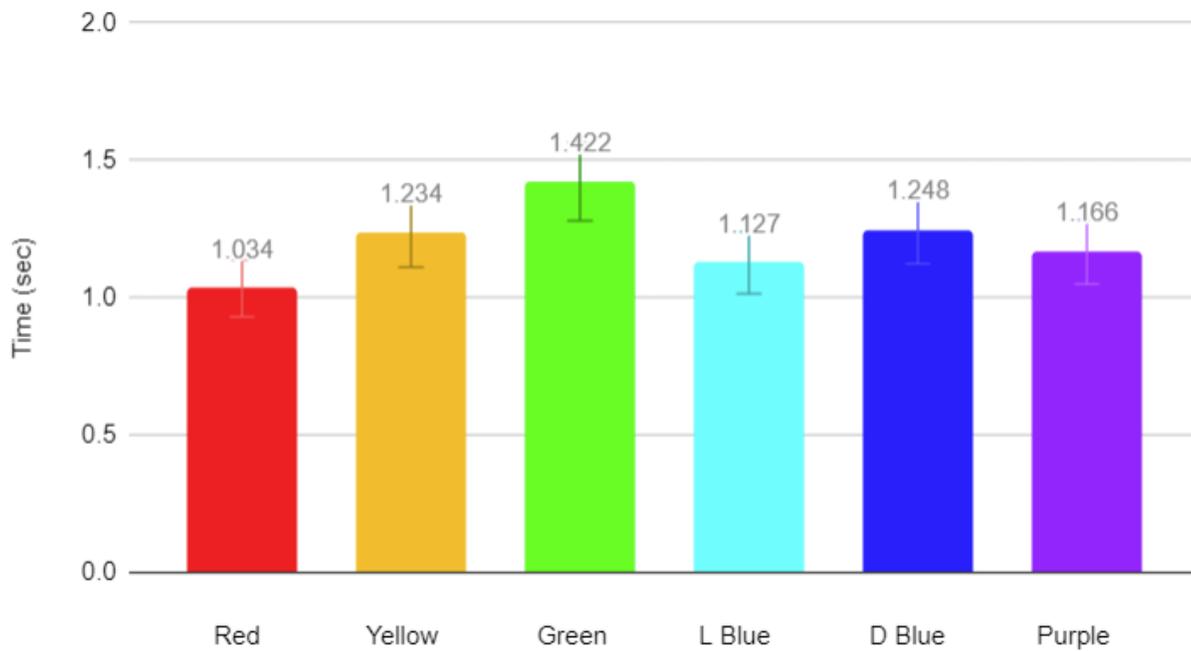
Present: Maggie, Shriya, Ella, Gianna, Simon, Sarah

Goals: Upload Testing data

Content:

attached below

Average Reaction Time (sec) per Color



Conclusions/action items:

Use on poster



2023/11/19 - Weight testing of device

SHRIYA KAUSHIK - Nov 19, 2023, 3:12 PM CST

Title: Weight testing of device

Date: 11/19/2023

Content by: Shriya Kaushik

Present: all

Goals:

- Conduct testing if the rod among all 6 team members
- During testing, two thresholds were measured: Time until uncomfortable and Time until one can no longer hold the rod

Content:

See attached

Conclusions/action items:

Create histogram chart displaying testing results

Talk with team and client about how to reduce overall weight of the device

SHRIYA KAUSHIK - Nov 19, 2023, 3:12 PM CST

Name	Uncomfort (Sec)	Max Time (Sec)
Shriya Kaushik	11:28 (8)	11:38 (30)
Shriya Kaushik	1:09 (80)	1:39 (80)
Shriya Kaushik	4:2	8:1
Shriya Kaushik	5:2 (1:07 (61))	
Shriya Kaushik	8:8 (1:38 (88))	
Shriya Kaushik	9:5 (1:05 (65))	
Shriya Kaushik	3:0 (1:32 (82))	
Shriya Kaushik	5:0 (1:14 (74))	
Shriya Kaushik	2:1 (1:34 (84))	
Shriya Kaushik	4:3 (1:23 (73))	
Shriya Kaushik	8:8 (1:24 (84))	
Shriya Kaushik	3:2	8:8

[Download](#)

Weight_Testing_-_Sheet1.pdf (26.5 kB)



2023/12/1 - Statics Calculations of Weight and Moments

SHRIYA KAUSHIK - Dec 01, 2023, 1:03 PM CST

Title: Statics Calculations of Weight and Moments

Date: 12/1/23

Content by: Shriya Kaushik

Present: all

Goals: Determine the moments of different situations with the pole.

Content:

Conducted three mathematical calculations of the pole and its moments and weights

Situation 1: fully extended pole, no modifications to current design

Moment calculated = -2.67 Nm

Situation 2: solve weight for added counterweight at end of the pole near

Weight needed for counterweight: 1.88 kg = 4.15 lbs

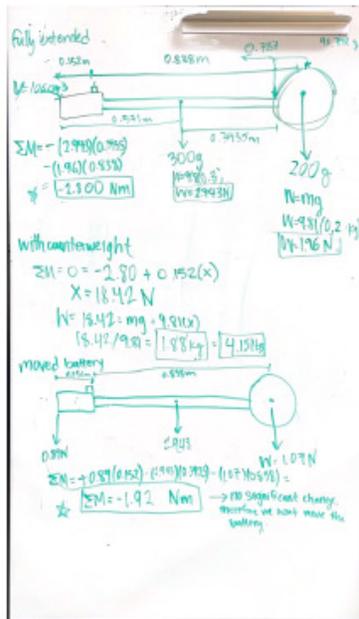
Situation 3: move the battery to the end of the pole

Moment calculated = -1.92 Nm

Conclusions/action items:

If we move the battery to the end of pole, the moment reduces by around 0.9 Nm. This is a change, but not sure if it is significant enough to move the battery and rewire everything. Instead, we are planning on getting counterweight marble balls and inserting into the handle and hollow out the pole.

SHRIYA KAUSHIK - Dec 01, 2023, 12:59 PM CST



[Download](#)

2023/12/9 - Moment Calculations for poster

Maggie LaRose - Dec 09, 2023, 10:56 AM CST

Title: Moment Calculations for poster

Date: 12/9/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Complete moment calculations for 4 scenarios: Full extended battery moved to handle vs at disk, and half extended battery move to handle vs at disk

Content:

Attached below

Conclusions/action items:

Create curves from data in google sheets

Maggie LaRose - Dec 09, 2023, 10:54 AM CST

distance battery button to centroid case: 33"
 d bottom button to bottom case: 31" dia case: 4"

No counterweight

$F = mg$
 $F_{rod} = (0.3 \text{ kg})(9.81 \text{ m/s}^2) = 2.943 \text{ N}$
 $F_{disk} = (0.2 \text{ kg})(9.81 \text{ m/s}^2) = 1.962 \text{ N}$

$\sum M_A = 0 = -(1.962 \text{ N})(0.838 \text{ m}) - (2.943 \text{ N})(0.3052 \text{ m}) + M_A$
 $M_A = 2.542 \text{ N}\cdot\text{m}$

Battery pack weight

weight 1 AAA battery: 11.5 g total: $4 \times 11.5 = 44.762$
 weight 4 AAA battery case: 44.742 g = 90.742 g

Counterweight (to minimize reaction moment)

$\sum M_A = 0$ $M_A = F_{rod}(0.3052 \text{ m}) - F_{disk}(0.838 \text{ m}) + F_{cw}(0.152 \text{ m})$
 $M_A = 2.542 \text{ N}\cdot\text{m} - F_{cw}(0.152 \text{ m})$ $F_{cw} = 14.7287 \text{ N}$ when $M_A = 0$

[Download](#)

Moment_calculations.pdf (1.46 MB)

$$\begin{aligned}F &= mg \quad \text{mass of } m_1 = 300 \text{ g} \quad \text{mass of } m_2 = 200 \text{ g} \quad a = 9.81 \text{ m/s}^2 \\F_{m_1} &= (0.300 \text{ kg})(9.81 \text{ m/s}^2) \quad F_{m_2} = (0.200 \text{ kg})(9.81 \text{ m/s}^2) \\ \sum M_o &= 0 = F_{m_1}(0.178 \text{ m}) + F_{m_2}(0.546 \text{ m}) - C_w(9.81 \text{ m/s}^2)(0.152 \text{ m}) - M_o \\ M_o &= 1.505 - 1.41 \text{ Cw}\end{aligned}$$

[Download](#)

calcs_300.docx (6.41 kB)



2023/12/9 - Moment Graphs

Maggie LaRose - Dec 09, 2023, 10:57 AM CST

Title: Moment Graphs for Poster

Date: 12/9/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Create moment graphs for 4 scenarios for poster testing section

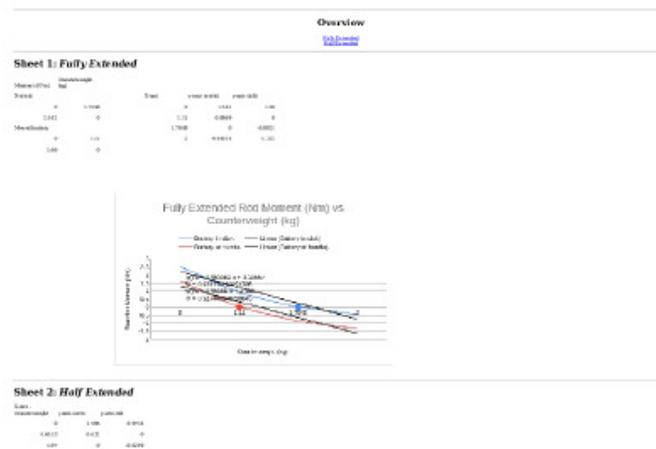
Content:

Attached below

Conclusions/action items:

Create poster testing section

Maggie LaRose - Dec 09, 2023, 10:57 AM CST



[Download](#)

Moment_graphs.xlsx (9.87 kB)



2023/12/9 - Client Survey

Maggie LaRose - Dec 09, 2023, 11:17 AM CST

Title: Client Survey Responses

Date: 12/9/2023

Content by: Maggie, Shriya, Ella, Gianna, Simon, Sarah

Present: Maggie, Shriya, Ella, Gianna, Simon, Sarah

Goals: Upload survey responses

Content:

attached below

Conclusions/action items:

Use on poster testing section

Maggie LaRose - Dec 09, 2023, 11:17 AM CST



[Download](#)

Survey_for_Dan.csv.zip (1.16 kB)



2023/12/9 - Counterweight Testing Results

Maggie LaRose - Dec 09, 2023, 11:25 AM CST

Title: Usability Counterweight Testing Results

Date: 12/9/2023

Content by: Maggie, Shriya, Ella, Gianna, Simon, Sarah

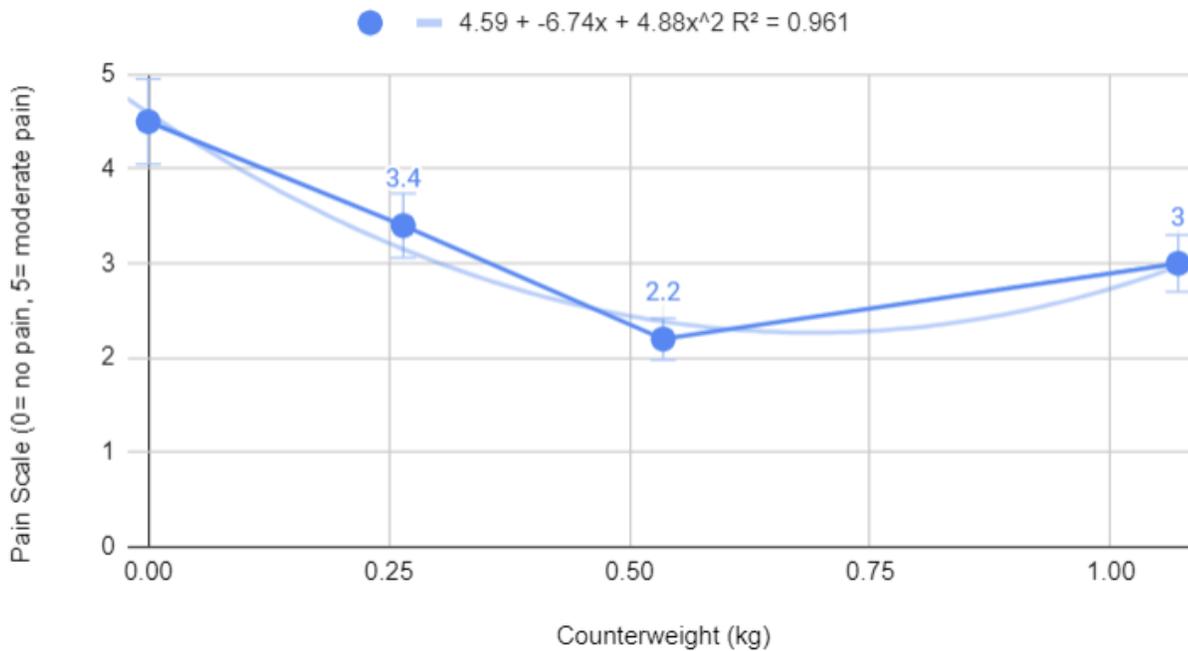
Present: Maggie, Shriya, Ella, Gianna, Simon, Sarah

Goals: Complete counterweight testing

Content:

attached below

Applied Counterweight (kg) vs User Comfort (Pain Scale)



Conclusions/action items:

Use on poster



2023-09-22 PDS Document

SHRIYA KAUSHIK - Sep 28, 2023, 9:46 PM CDT

Title: Product Design Specifications

Date: 09-28-2023

Content by: All

Present: n/a

Goals: PDS document

Content:

see pdf

Conclusions/action items:

Work on design matrix by formulating three design ideas.

SHRIYA KAUSHIK - Sep 28, 2023, 9:47 PM CDT



DYNAMIC BALANCE DEVICE

PRELIMINARY PRODUCT DESIGN SPECIFICATIONS

DATE: 200-210

Client: Mr. Das Kancham
Advisor: Dr. Fikri Yesilkoy

Team Members:

Shriya Kaushik, Team Leader
Maggie LaRose, Team Leader
Ellis Long, Communicator
Simon Nara, SPAG
Sarah Barabantine, RWIG
Channa Inga, BSAC

September 22, 2023

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PDS_- Dynamic_Balance.pdf (210 kB)



2023/10/6 - Preliminary Design Presentation

Maggie LaRose - Oct 08, 2023, 10:32 AM CDT

Title: Preliminary Design Presentation

Date: 10/6/2023

Content by: Maggie LaRose, Shriya Kaushik, Ella Lang, Gianna Inga, Sarah Raubenstine, and Simon Nam

Present: Maggie LaRose, Shriya Kaushik, Ella Lang, Gianna Inga, Sarah Raubenstine, and Simon Nam

Goals: Complete presentation

Content:

see pdf attached

Conclusions/action items:

Complete preliminary design report

Maggie LaRose - Oct 08, 2023, 10:30 AM CDT



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Preliminary_Design_Presentation_-_Dynamic_Balance.pdf (1.36 MB)



2023-10-11 Preliminary Design Report

SHRIYA KAUSHIK - Oct 11, 2023, 9:55 PM CDT

Title: Preliminary Design Report

Date: 10/11/23

Content by: All

Present: n/a

Goals: Finish our report before we start fabricating our project.

Content:

see pdf attached

Conclusions/action items:

Start fabrication process.

SHRIYA KAUSHIK - Oct 11, 2023, 9:56 PM CDT



Dynamic Balance Device

Preliminary Report
Biomedical Engineering Design 200300
Department of Biomedical Engineering
University of Wisconsin-Madison
October 11, 2023

Team Members:

Shriya Kaushik (Team Leader)
Maggie LaRose (Team Leader)
Ella Lutz (Communicator)
Samir Rabinowitz (BME)
Simon Nam (BME)
Gianna Jago (BSAC)

Client:

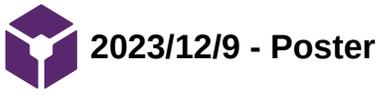
Mr. Dan Kitchers, (Physical Therapist, Fitchburg, WI)

Advisor:

Dr. Filitz Jesilow Ph.D, Department of Biomedical Engineering, College of Engineering, University of Wisconsin

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Preliminary_Design_Report_-_Dynamic_Balance.pdf (6.26 MB)



Maggie LaRose - Dec 09, 2023, 11:28 AM CST

Title: Poster

Date: 12/9/2023

Content by: Maggie, Shriya, Ella, Simon, Sarah, Gianna

Present: Maggie, Shriya, Ella, Simon, Sarah, Gianna

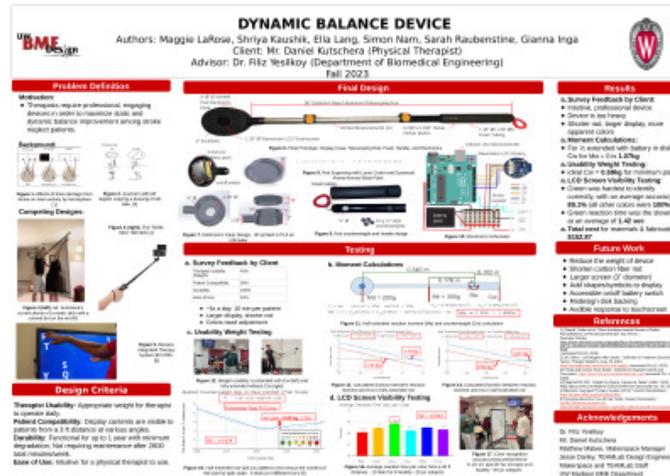
Goals: Upload final poster

Content:

attached below

Conclusions/action items:

Maggie LaRose - Dec 09, 2023, 11:29 AM CST



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Dynamic_Balance_Device_Poster.pptx (8.07 MB)



2023/12/13 - Final Report

Maggie LaRose - Dec 13, 2023, 2:55 PM CST

Title: Final Report - Dynamic Balance Device

Date: 12/13/2023

Content by: Maggie, Shriya, Simon, Ella, Gianna, Sarah

Present: Maggie, Shriya, Simon, Ella, Gianna, Sarah

Goals: Submit final report

Content:

Attached below

Conclusions/action items:

Maggie LaRose - Dec 13, 2023, 2:54 PM CST

Final Report: Dynamic Balance Device



Biomedical Engineering Design
Department of Biomedical Engineering
University of Wisconsin-Madison
December 13th, 2023

Client

Mr. Daniel Kutschera (Physical Therapist, Neuroscience Health)

Professors

Dr. Fikre Youdey (Department of Biomedical Engineering)

Team

Maggie LaRose (Co-Leader)
Shriya Kamath (Co-Leader)
Ella Lang (Communicator)
Oliver Ingo (BSAC)
Sarah Rothermel (BWDG)
Simon Nunn (BPAC)

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BME_200_300_Final_Report_-_Dynamic_Balance_Device.docx.pdf (11.2 MB)



2023/09/10 - Dynamic Balance Training

Maggie LaRose - Sep 10, 2023, 2:51 PM CDT

Title: Dynamic Balance Training

Date: 9/10/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Learn basics of static/dynamic balance and the benefits for balance training

Content:

Link to source: [https://www.getwellen.com/well-guide/dynamic-balance-exercises#:~:text=Dynamic%20balance%20\(moving%20balance\)%20requires,is%20important%20for%20fall%20prevention.](https://www.getwellen.com/well-guide/dynamic-balance-exercises#:~:text=Dynamic%20balance%20(moving%20balance)%20requires,is%20important%20for%20fall%20prevention.)

See attached notes below

Conclusions/action items:

Ask client specifics of exercises done with stroke patients

Maggie LaRose - Sep 10, 2023, 2:51 PM CDT

stroke neglect syndrome - lack of awareness of remaining side

effects:

- reduce independence
 - increase potential risk of injury
 - difficulty w/ navigation/balance/eating/seeing
- caused by "damage to the right cerebral hemisphere after the right middle cerebral artery stroke"

Static balance - standing/sitting still

dynamic balance - movement → good static balance, reaction time to deal w/ changes to position
 = center of gravity

proprioception - body's ability to sense where its parts are located and how they are moving
 "sixth sense"

Exercises

- stationary marching → maintain single-leg balance while moving the other leg

[Download](#)

Dynamic_Balance_Training.pdf (739 kB)



2023/09/10 - Stroke Neglect Syndrome

Maggie LaRose - Oct 04, 2023, 4:07 PM CDT

Title: Stroke Neglect Syndrome

Date: 9/10/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Learn the effects of strokes on balance

Content:

See attached notes below

<https://www.ncbi.nlm.nih.gov/books/NBK562184/#:~:text=Spatial%20Neglect%20is%20a%20neuropsychological,healthcare%20team%20in%20patient%20management.>

- also called "spatial neglect"

-

Conclusions/action items:

Do more research or neurodegenerative diseases

Maggie LaRose - Sep 10, 2023, 2:53 PM CDT

stroke neglect syndrome - lack of awareness of
recoiling side

effects:

- reduce independence
 - increase potential risk of injury
 - difficulty w/ navigation/balance/eating/seeing
- caused by "damage to the right cerebral hemisphere
after the right middle cerebral artery stroke"

Static balance - standing/sitting still

Dynamic balance - movement → good static
balance, reaction time to deal w/ changes to position
∴ center of gravity

proprioception - body's ability to sense where
its parts are located and how they are moving
"sixth sense"

Exercises

- Stationary marching → maintain single-leg balance
while moving the other leg

[Download](#)

Dynamic_Balance_Training.pdf (739 kB)



2023/10/4 - Stroke Recovery

Maggie LaRose - Oct 05, 2023, 10:05 AM CDT

Title: Stroke Recovery

Date: 10/4/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Gain more general knowledge of stroke neglect for presentation

Content:

“Treat and recover from stroke,” Centers for Disease Control and Prevention, <https://www.cdc.gov/stroke/treatments.htm> (accessed Oct. 4, 2023).

“What to expect as you recover from a stroke,” Mayo Clinic, <https://www.mayoclinic.org/diseases-conditions/stroke/in-depth/stroke-rehabilitation/art-20045172> (accessed Oct. 4, 2023).

Conclusions/action items:

Complete part of presentation



2023/10/2 - Left Side Neglect

Title: Left Side Neglect Syndrome

Date: 10/4/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Answer question as to why left side neglect is more common than right

Content:

C. Maher, "Left neglect after brain injury: Causes, treatment, & exercises," Flint Rehab, <https://www.flintrehab.com/left-neglect-brain-injury/> (accessed Oct. 4, 2023)

L. J. Williams, J. Kernot, S. L. Hillier, and T. Loetscher, "Spatial neglect subtypes, definitions and assessment tools: A scoping review," Frontiers, <https://www.frontiersin.org/articles/10.3389/fneur.2021.742365/full#:~:text=Prevalence%20estimates%20of%20neglect%20range%20from%2025%20to,of%20recc> (accessed Oct. 4, 2023).

Conclusions/action items:

Complete part of presentation



2023/09/10 - Existing Collapsible Poles

Maggie LaRose - Sep 10, 2023, 2:34 PM CD

Title: Types of Collapsible Poles**Date:** 9/10/2023**Content by:** Maggie LaRose**Present:** Maggie LaRose**Goals:** Evaluate different options for pole aspect of device**Content:**

Types of rods to consider:

- telescoping rods
- camera monopods
- boom poles (fixed length)
- tent poles - collapses by folding over sections
- selfie stick (fixed) - attach phone for more versatility of display
- white canes for visually impaired people

amazon links:

Telescoping poles for painting/cleaning/dusting:

https://www.amazon.com/EVERSPROUT-Telescopic-Extension-Lightweight-Rust-Resistant/dp/B07WRSJQN6/ref=sr_1_2_sspa?keywords=telescoping%2Bpole&qid=1694373386&sr=8-2-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

https://www.amazon.com/Telescopic-Multi-Purpose-Extendable-Lightweight-Telescoping/dp/B084G661WS/ref=sr_1_1_sspa?keywords=telescoping%2Bpole&qid=1694373386&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

https://www.amazon.com/Unger-Professional-Connect-Clean-Multi-Purpose/dp/B0B9V18FCF/ref=sr_1_5?keywords=telescoping%2Bpole&qid=1694373386&sr=8-5&th=1

https://www.amazon.com/ITTAHO-Telescoping-Attachment-Microfiber-Cleaning-Black-4-8/dp/B085HDNNSQ/ref=asc_df_B085HDNNSQ/?tag=hyprod-20&linkCode=df0&hvadid=563645139568&hvpos=&hvnetw=g&hvrnd=9511130276498595129&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=pl1650494072302&th=1

Camera monopods:

https://www.amazon.com/Altura-Photo-62-Inch-Camera-Monopod/dp/B077T3G4K3?source=ps-sl-shoppingads-lpcontext&ref_=fplfs&pvc=1&smid=A1WFSHX6J483SX

https://www.amazon.com/AmazonBasics-WT1003-67-Inch-Monopod/dp/B00FAYL1YU/ref=asc_df_B00FAYL1YU/?tag=hyprod-20&linkCode=df0&hvadid=167143377764&hvpos=&hvnetw=g&hvrnd=377332197351290845&hvpon=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=pl77671288886&th=1

Conclusions/action items:

Ask client for preferences during meeting



2023/10/9 - Competing Balance Devices

Title: Competing Balance Devices

Date: 10/9/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Research competing balance devices

Content:

Biodex Balance System SD:

"Biodex Balance System SD," IPRS Mediquipe. <https://www.iprsmediquipe.com/products/biodex-balance-system-sd/#specifications> (accessed Oct. 10, 2023).



Shuttle Balance Professional:

"Balance Professional," Shuttle Systems. <https://www.shuttlesystems.com/products/balance-professional> (accessed Oct. 10, 2023).



Conclusions/action items:

None apply in functionality to a handheld USN therapeutic device with digital display



2023/11/15 - RGB Color Code

Maggie LaRose - Nov 15, 2023, 12:13 PM CST

Title: RGB Color Table for Arduino Code

Date: 11/15/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Make more diverse color options in Arduino Code

Content:

[1] RapidTables, "RGB Color Codes Chart," *Rapidtables.com*, 2019.

https://www.rapidtables.com/web/color/RGB_Color.html

Use for color code to make more diverse colors

Conclusions/action items:

Integrate into Arduino code



2023/11/10 - Tong Lecture

Maggie LaRose - Nov 10, 2023, 12:35 PM CST

Title: Tong Lecture

Date: 11/10/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Take notes on Tong lecture - Travelle Ellis MD PhD

Content:

1. Find your people
 2. Do the things that scare you
 3. laugh until you cry - cry until you laugh
- engaging with others and finding likeminded people
 - lean into practice at university
 - everyone is counting on you

Conclusions/action items:



2023/09/10 - Preliminary Design Ideas

Maggie LaRose - Sep 10, 2023, 2:50 PM CDT

Title: Preliminary Design Ideas

Date: 9/10/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Write down thoughts for improvements on client's current design

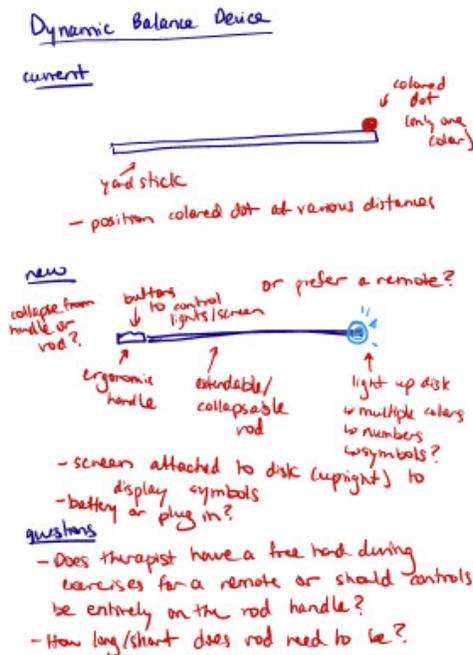
Content:

See attachment below

Conclusions/action items:

Ask client for feedback during first meeting

Maggie LaRose - Sep 10, 2023, 2:51 PM CDT



[Download](#)

Preliminary_notes.pdf (1.36 MB)



2023/9/17 - 7-segment arduino display with IR Remote

Maggie LaRose - Sep 17, 2023, 6:51 PM CDT

Title: 7-segment arduino display with IR remote

Date: 9/17/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Discover way to create serial display on arduino that is controlled by an IR remote

Content:

- pretty cheap to buy single 7-segment serial displays on sparkfun:

<https://www.sparkfun.com/products/8546>

- youtube video describes how to set up the breadboard and download code for pairing the IR remote:

<https://www.youtube.com/watch?v=d8r0JvsIjqA>

-place to buy ir remote:

https://www.amazon.com/Alinan-Infrared-Control-Controller-Receiver/dp/B0C4Y5245T/ref=sr_1_8?keywords=infrared+remote+control&qid=1694994244&sr=8-8

- arduino random dice roller code:

<https://forum.arduino.cc/t/arduino-random-dice-roller-and-dice-selector/580915>

or

<https://www.circuitbasics.com/arduino-7-segment-display-tutorial/>

- places to buy LED strip lights with remote on amazon:

https://www.amazon.com/s?k=led+light+strips%27&hvadid=580649750528&hvdev=c&hvlocphy=9018948&hvnetw=g&hvqmt=e&hvrnd=3330962332489578249&hvtargid=kwd-1394255102334&hydadcr=16030_13514500&tag=googhydr-20&ref=pd_sl_2dzgle6yyu_e

Conclusions/action items:

- way to make this more compact, arduino very bulky for application

- how to design handle to accomodate two remotes (one for serial display and one for LED lights)



2023/09/17 - Disk Design idea 9/17

Maggie LaRose - Sep 17, 2023, 6:52 PM CDT

Title: Design Idea (Disk Light)

Date: 9/17/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: plan out disk aspect of device

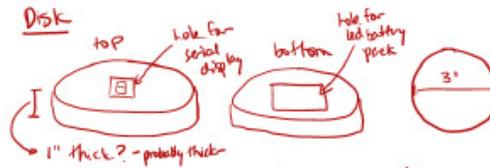
Content:

see attached document

Conclusions/action items:

discuss ideas at design brainstorm

Maggie LaRose - Sep 17, 2023, 6:57 PM CDT



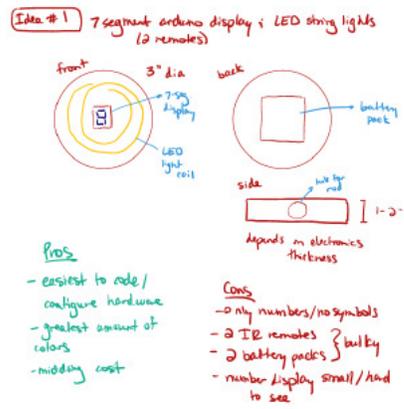
- 1" thick? - probably thicker
- 3D printed hollow w/ translucent filament on Ultimaker printer - thickness 1/8"?
- thickness dict by breadboard, LED lights, & battery pack
- 7-segment serial display LED - sparkfun
- LED strip lights - Amazon
- telescoping rod - Amazon
- serial display IR remote - Amazon
- additional Arduino/bread board → sparkfun

Alternative to serial display/LED strip



[Download](#)

Design_idea_9-17.pdf (587 kB)



[Download](#)

Electronics_ideas.pdf (1.07 MB)



2023/10/8 - PDS design for presentation

Maggie LaRose - Oct 08, 2023, 10:29 AM CDT

Title: PDS design for presentation

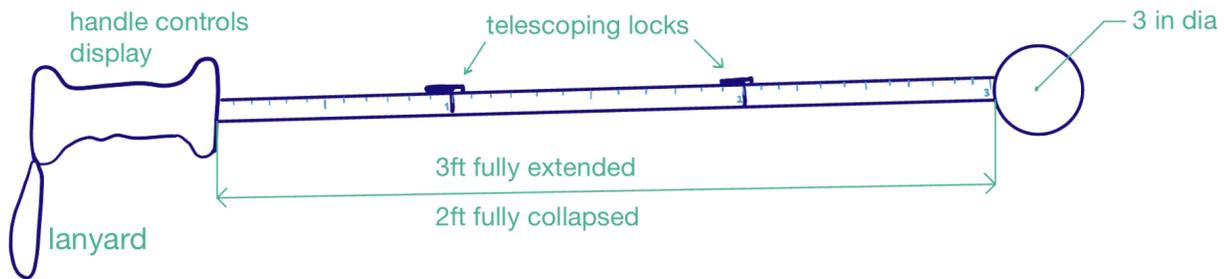
Date: 10/8/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: complete general overview of what device all together looks like

Content:



Conclusions/action items:

include in presentation and preliminary report



2023/10/20 - Testing Research

Maggie LaRose - Oct 20, 2023, 12:52 PM CDT

Title:

Date:

Content by:

Present:

Goals:

Content:

- mechanical properties of rod
- survey, usability for therapist and patient
- electronics testing? visibility
- functionality testing on coding
- calculate battery life
-

Conclusions/action items:



2023/10/20 - LCD Module Documentation

Maggie LaRose - Oct 20, 2023, 1:39 PM CDT

Title: LCD 1.28" Waveshare Module - Arduino code and hardware setup

Date: 10/20/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Download Arduino code

Content:

website: https://www.waveshare.com/wiki/1.28inch_LCD_Module#Run_program

Conclusions/action items:

Hookup arduino with waveshare LCD screen



2023/10/20- Powering Arduino with a Battery

Maggie LaRose - Oct 20, 2023, 1:40 PM CDT

Title: Powering Arduino with a Battery

Date: 10/20/2023

Content by: Maggie LaRose

Present: Maggie LaRose

Goals: Figure out how to make Arduino microcontroller standalone by battery power

Content:

website: <https://www.instructables.com/Powering-Arduino-with-a-Battery/>

Conclusions/action items:

hookup arduino with battery



2023/11/15 - Arduino Code - Shape Dice Roller

Title: Arduino Code - Shape/Color Dice Roller**Date:** 11/15/2023**Content by:** Maggie LaRose**Present:** Maggie LaRose**Goals:** Develop Arduino code to display random shapes/colors with click of button**Content:**

```
#include <SPI.h>
#include "LCD_Driver.h"
#include "GUI_Paint.h"
#include "image.h"

void setup(){

  Config_Init();
  LCD_Init();
  LCD_SetBacklight(1000);
  Paint_NewImage(LCD_WIDTH, LCD_HEIGHT, 0, BLACK);
  Paint_Clear(BLACK);
  Paint_DrawString_EN(50, 120, "Click to Begin", &Font16, WHITE, WHITE);
  Paint_DrawString_EN(120, 140, ":)", &Font16, WHITE, WHITE);

  const int button = 2;
  pinMode(button, INPUT);

  randomSeed(analogRead(0));

}

void loop(){

  if (digitalRead(2) == HIGH){
    int result = rollDice();
    if(result == 1){
      Paint_Clear(RED);
    }
    if(result == 2){
      Paint_Clear(YELLOW);
    }
    if(result == 3){
      Paint_Clear(GREEN);
    }
    if(result == 4){
      Paint_Clear(BLUE);
    }
    if(result == 5){
      Paint_Clear(WHITE);
    }
    if(result == 6){
      Paint_Clear(BLACK);
    }
    delay(1000);
  }
}

int rollDice(){
  return random(1, 7);
}
```

Conclusions/action items:

Develop visibility testing code



09/14/2023 - Neglect Stroke Patients

SHRIYA KAUSHIK - Sep 14, 2023, 7:07 PM CDT

Title: Stroke Neglect Patients research

Date: 09/14/2023

Content by: Shriya Kaushik

Present: n/a

Goals: Learn more about the type of patients that our client works with to get a better understanding of who and what our product must be geared to

Content:

Link: <https://www.ncbi.nlm.nih.gov/books/NBK562184/>

IEEE citation:

A. Sarwar and P. D. Emmady, "Spatial Neglect," in *StatPearls*, Treasure Island (FL): StatPearls Publishing, 2023. Accessed: Sep. 14, 2023. [Online]. Available: <http://www.ncbi.nlm.nih.gov/books/NBK562184/>

- Spatial neglect is a condition affecting someone neuropsychologically.
- It is caused through damage to right cerebral hemisphere after a stroke to the right middle cerebral artery.
- Can also be called Unilateral or Hemineglect syndrome
- this syndrome can be presented as non-dominant, so if one is right dominant, it would present on the left side of their body
- This illness is a behavioral disorder and can affect other components like perceptual, representational, visuospatial and behavioral aspects to one's body
- Effects: attention diversion and eye movements towards the affected side
- other issues that can cause neglect among patients are if they experienced TBI (Traumatic Brain Injury), neoplasia, and other aneurysms.
- Some other effects that family members have reported among patients with Neglect syndrome are inability to dress themselves, using the contralateral limb, and severe behavioral changes
- Spatial neglect affects different aspects of spatial processing: Perception-attention neglect, motor intentional aiming deficits, representational neglect
- Perception Attention neglect: people with neglect may not be able to perceive or understand events happening on the neglected side
- Motor intentional aiming deficits: May not be able to perform activities on the contralesional side even if the motor system of neglected side is intact.
- Representational neglect: Also called imagery neglect, patients will have internal mapping of scenes of events on the defective left side.
- This illness can cause several behavioral changes including: being unaware of the deficit, being unaware of the defected side (example: asymmetric grooming)
- Several ways to test neurological awareness: Cancellation test, line bisection test, drawing test, multitasking, reading
- Many ways to approach rehab with these neglect patients: visual exploration, intensive motor therapy, neck muscle vibration to the affected side

Conclusions/action items:

This article helped me understand stroke neglect syndrome and helped me better comprehend what a patient going through this illness would endure. I plan on continuing researching this topic and start looking at existing devices.



2023/09/14 - Existing Adaptable devices

SHRIYA KAUSHIK - Sep 14, 2023, 7:19 PM CDT

Title: Existing Adaptable Devices

Date: 09/14/2023

Content by: Shriya Kaushik

Present: N/a

Goals: Learn about existing devices on the market and try to understand what elements we can potentially improve upon in our prototype. Learn about existing items that these patients use in their daily life.

Link: <https://www.flintrehab.com/occupational-therapy-tools-for-stroke-patients/>

IEEE: "Occupational Therapy Tools for Stroke Patients," Flint Rehab, Feb. 27, 2023. <https://www.flintrehab.com/occupational-therapy-tools-for-stroke-patients/> (accessed Sep. 14, 2023).

Content:

-There are lots of different everyday items that people are able to use to help them live their everyday lives with ease

-Some of these equipment include:

-Adaptive utensils : utensils with built-up handles, weighted and angled utensils

-Rocker knives and adaptive cutting boards

-Adaptive fasteners for Bras, Zippers, shoe laces, buttons to help patients wear their clothes in an adaptive way

As for Occupational Therapy: there are devices that patients can use at home that include technology to help these patients with their hand movements and cognitive therapy

"MusicGlove Hand Therapy"- https://www.flintrehab.com/product/musicglove-hand-therapy/?utm_source=Blog&utm_medium=MusicGlove%20Inside%20Article

this is an example of neuro rehab that helps to improve mobility for hands and fingers, combining music and games.. similar to guitar hero but patients must tap their fingers appropriately to the right beats

There are also CT Speech and Cognitive therapy apps for patients to use at their ease at home. It would help with speech, language deficits. Targets speech therapy

These products are great for helping patients regain their independence, however, this may not target regaining strength and coordination, which is what a professional could help these patients with

Conclusions/action items:

This research aided with learning about the existing devices that patients can use outside of professional help to help improve their cognitive and motor skills. Next I will research other professional existing devices that Physical therapists use to help patients improve their visual and spatial awareness skills.



2023-09-25 LCD Touch Screen Display

Title: LCD Touch Screen**Date:** 09-25-2023**Content by:** Shriya Kaushik**Present:** N/a**Goals:** Learn about LCD touch screen display for implementing into the disk**Content:**<https://www.waveshare.com/product/1.28inch-lcd-module.htm>

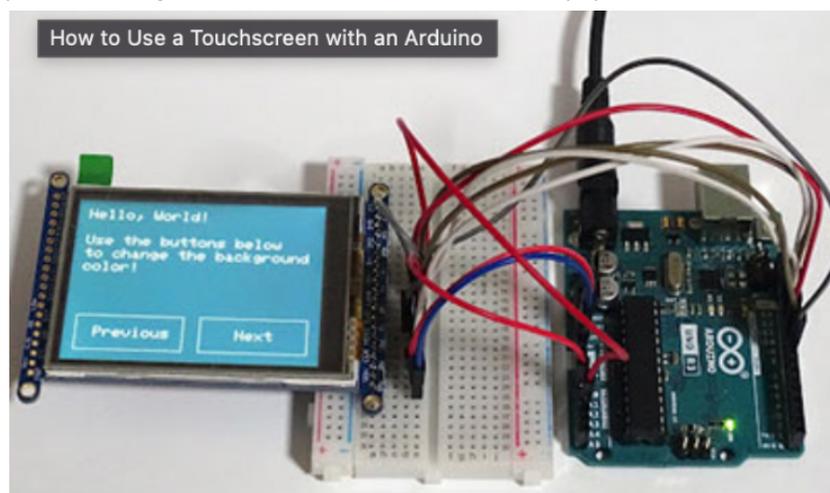
IEEE: "1.28inch Round LCD Display Module, 65K RGB Colors, 240×240 Resolution, SPI Interface." Accessed: Sep. 28, 2023. [Online]. Available: <https://www.waveshare.com/product/1.28inch-lcd-module.htm>

- 1.28" touchscreen display that can display over 65K colors
- compatible with Arduino and Raspberry Pi
- included with buying the display, you get arduino wires. We would need to use one of our existing arduinos

This is what the LCD touchscreen looks like. The company that manufactures and sells this is Waveshare.



- another possibility is to use an Arduino display that can be coded to be touchscreen too. here is an image of this:



<https://www.digikey.com/en/maker/blogs/2022/how-to-use-a-touchscreen-with-an-arduino> (good alternative in case the touch screen does not work)

Conclusions/action items:

Learn more about the API documentation and watch videos to see how others were able to code the touchscreen using Arduino



2023-09-25 LCD touchscreen different screens

SHRIYA KAUSHIK - Sep 28, 2023, 9:43 PM CDT

Title: Different screens of the LCD touchscreen display

Date: 09/25/23

Content by: shriya

Present: n/a

Goals: Map out what we want to see on our LCD touchscreen display and see what screens are necessary to be coded. then we can think about how to code those screens

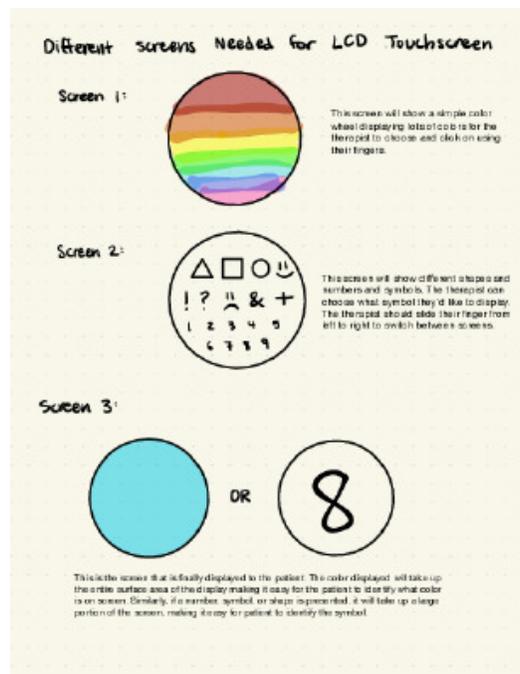
Content:

see pdf attached

Conclusions/action items:

Look at documentation for code to see how to code the different screens

SHRIYA KAUSHIK - Sep 28, 2023, 9:43 PM CDT



[Download](#)

BME_300-_lcd_touchscreen_screens.pdf (491 kB)



2023-09-27 Potential Combined Design Idea

SHRIYA KAUSHIK - Sep 28, 2023, 9:27 PM CDT

Title: Potential Combined Design idea

Date: 9/27/23

Content by: Shriya

Present: n/a

Goals: Get a better understanding of what the final product will look like once we combine all three aspects

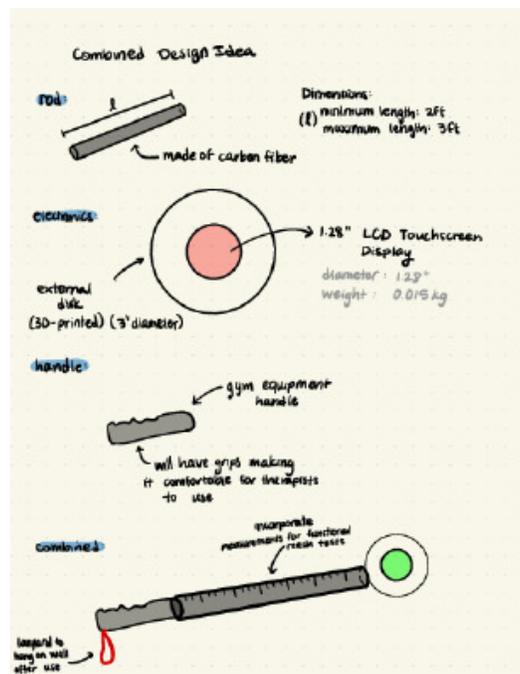
Content:

see pdf below

Conclusions/action items:

This is what the final product will probably look like. This is helpful to be able to visualize what the client will receive at the end of the semester (ideally), given we finish the project on time.

SHRIYA KAUSHIK - Sep 28, 2023, 9:23 PM CDT



[Download](#)

BME_300_Combined_Design.pdf (1.15 MB)



2023-09-28 Arduino coding steps Chat GPT

Title: Coding steps for Arduino**Date:** 09/29/2023**Content by:** Shriya**Present:** n/a**Goals:** Learn what steps need to be taken. Use this as a guide of what to do to program in Arduino**Content:**

Source: ChatGPT

Programming an LCD touchscreen display with Arduino to change colors and display numbers based on user input is a common and achievable project. Here are the general steps to get you started:

1. Gather Your Components:

Arduino board (e.g., Arduino Uno, Arduino Mega)

Touchscreen LCD display (e.g., TFT LCD)

Appropriate cables and connectors

Breadboard and wires

2. Install Necessary Libraries:

You'll need to install libraries for both the touchscreen and the display. Popular libraries include:

Adafruit GFX Library: This library provides graphics capabilities for drawing shapes and text on the display.

Adafruit ILI9341 or ST7735 Library: Choose the library that matches your LCD display model. These libraries provide drivers for the displays.

Adafruit TouchScreen Library: Use this library for interfacing with the touchscreen.

You can install these libraries via the Arduino IDE's Library Manager.

3. Wiring:

Connect the touchscreen and the LCD display to your Arduino. The exact wiring will depend on your specific hardware. Refer to the datasheets and library documentation for guidance on the connections.

4. Code:

Here's a basic outline of what your Arduino sketch might look like:

```
cpp
Copy code
#include <Adafruit_GFX.h>
#include <Adafruit_ILI9341.h>
#include <Adafruit_TouchScreen.h>

#define TFT_CS 10 // Chip select pin for the display
#define TFT_DC 9 // Data/command pin for the display
#define TS_CS 8 // Chip select pin for the touchscreen

Adafruit_ILI9341 tft = Adafruit_ILI9341(TFT_CS, TFT_DC);
#define TFT_WIDTH tft.width()
#define TFT_HEIGHT tft.height()

#define TS_MINX 150
#define TS_MINY 120
#define TS_MAXX 920
#define TS_MAXY 940

Adafruit_TouchScreen ts = Adafruit_TouchScreen(TS_CS, TS_MINX, TS_MINY, TS_MAXX, TS_MAXY);

void setup() {
  tft.begin();
  tft.setRotation(3); // Adjust the rotation if your display is oriented differently.
```

```
tft.fillScreen(ILI9341_BLACK);
}

void loop() {
  // Read touch input
  TSPoint p = ts.getPoint();
  if (p.z > 5) {
    // Touch detected, do something with the touch coordinates
    int16_t x = map(p.x, TS_MINX, TS_MAXX, 0, TFT_WIDTH);
    int16_t y = map(p.y, TS_MINY, TS_MAXY, 0, TFT_HEIGHT);

    // Example: Change the background color and display a number
    tft.fillScreen(ILI9341_BLUE); // Change the background color
    tft.setCursor(50, 50);
    tft.setTextSize(2);
    tft.setTextColor(ILI9341_YELLOW);
    tft.print("X: ");
    tft.println(x);
    tft.setCursor(50, 70);
    tft.print("Y: ");
    tft.println(y);
  }
}
```

This code initializes the display and touchscreen, and when a touch is detected, it changes the background color and displays the touch coordinates.

5. Customize and Extend:

You can customize the code to do more, like drawing shapes, displaying images, or creating interactive menus. You can also add logic to respond to different touch gestures.

Remember to refer to the specific datasheets for your display and touchscreen, and the documentation for the libraries you're using for further details and to ensure proper configuration.

6. Upload the Code:

Compile and upload the code to your Arduino using the Arduino IDE.

7. Test and Calibrate:

Test your setup and calibrate the touchscreen if necessary. Adjust the touchscreen mapping (TS_MINX, TS_MINY, TS_MAXX, TS_MAXY) if the touch coordinates are not accurate.

With these steps, you should be well on your way to creating a touchscreen interface with an Arduino and an LCD display. The possibilities are nearly endless in terms of what you can create, so feel free to experiment and build upon this foundation.

Conclusion/Action Items: Attempt to start coding. continue looking at other sources. Test it out when you receive the LCD display. first test should be to see if the color shows up with touch. Need to see if the code is able to pickup the user's touch and present the correct output response.



2023-10-25 Hinge between rod and disk

SHRIYA KAUSHIK - Oct 25, 2023, 7:13 PM CDT

Title: Hinge between rod and disk

Date: 10/25/2023

Content by: Shriya Kaushik

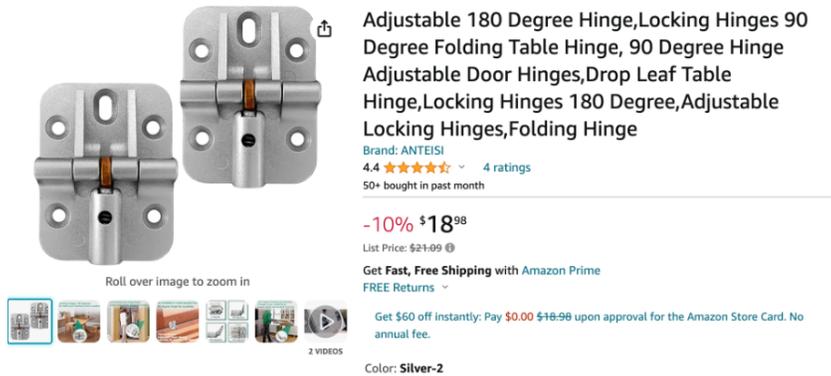
Present: n/a

Goals: Figure out if the hinge is something we can incorporate into the design.

Content:

Using this hinge would allow the therapist to adjust the angle and lock in the angle to show the patient the disk. This specific hinge is from Amazon and costs \$19. It would definitely help with rigidity, and holding the rod and the disk securely. Ideally, we would drill two holes into the rod on one panel, and on the other panel we would drill two holes into the Solidworks Disk.

Amazon Link: https://www.amazon.com/Adjustable-Locking-Folding-Bi-Fold-Cabinetsand/dp/B0BX26VLH4/ref=sr_1_17?crid=1MHP5A0LN3LCS&keywords=adjustable%2Bhinges&qid=1698278562&prefix=adjustable%2Bhinges%2Caps%2C94&sr=8-17&th=1



Benefits:

- The hinge can lock in multiple positions and different angles: 0°, 90°, 135°, and 180°.
- This provides variety for the therapist to adjust positioning of display to test the patients' vision and balance ability.

Conclusions/action items:

Discuss with team to see if implementation is possible. Order and make a plan to start fabricating once 3d printed Disk is ready.



2023-11-1 SolidWorks Design for Disk

SHRIYA KAUSHIK - Nov 01, 2023, 6:50 PM CDT

Title: SolidWorks Design for Disk

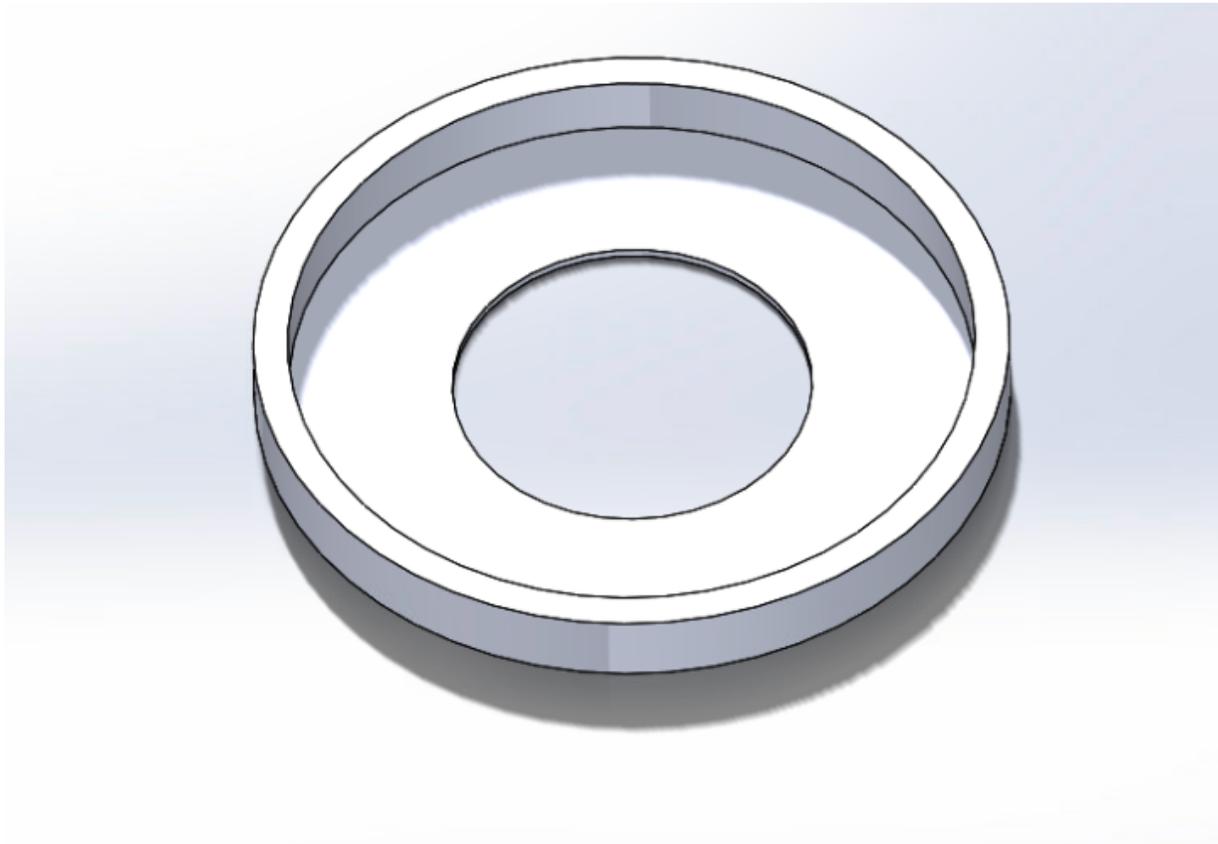
Date: 11-1-2023

Content by: Shriya Kaushik

Present: n/a

Goals: Come up with a design on solidworks for the Disk

Content:



Outer diameter: 4 in

Middle diameter: 3.7 in

Inner diameter: 1.6 in

Outer height: 0.80 in

inner height: 0.1 in

Conclusions/action items:

3D print the final SolidWorks design at the makerspace.



2023/09/11 TBIs and Vision Impairment

ELLA LANG - Sep 12, 2023, 9:15 AM CDT

Title: Research Regarding Brain Injuries and how they cause Vision Impairment

Date: 9/11/2023

Content by: Ella Lang

Goals:

- Specify the problems that TBI patients experience regarding vision
- Note any PT techniques used to help correct these problems
- Brainstorm potential upgrades for our balance device

Content:

Impairment areas affected by TBI:

Visual processing skills:

- Blurred vision
- Double vision
- Decreased peripheral vision
- Printed numbers or objects may appear to be moving
- Computer screens may hurt the eyes
- Sensitivity to light or glare

Perception skills:

- Depth perception
- Walk or hear at an angle
- Fall as though foot or surface is tilted

Common causes of these problems:

- Decreased eye movement, which can make it difficult to follow moving objects
- Eyes may not work together as much, making it hard to focus on something a piece of or far away
- The muscles within the eye are weak or damaged
- Decreased vision field- called hemianopia- which can cause patients to become injured from falling, bumping or being hit.

Strategies to manage vision problems:

- Magnify objects to avoid eye strain
- Increase the contrast of text or other print to make it stand out
- Reduce the glare of the windows or screens you find yourself using each day

J. Powell, L. Diney, A. Waltraut, and T. Novack, "Vision Problems and Traumatic Brain Injury | Model Systems Knowledge Translation Center (MSKTC)," *msktrc.org*, 2016.
<https://msktrc.org/followed/traumatic-brain-injury-problems-and-traumatic-brain-injury> (accessed Sep. 11, 2023).

[Download](#)

Research_regarding_Brain_Injuries_and_how_they_cause_Vision_Impairment.pdf (59.8 kB)



2023/09/12 Visual Field Testing

ELLA LANG - Sep 12, 2023, 9:58 AM CDT

Title: Visual Field Testing Article

Date: 9/12/2023

Content by: Ella Lang

Goals:

- Understand more of the biology behind vision loss
- Learn more about tests that currently asses central and peripheral vision

Content:

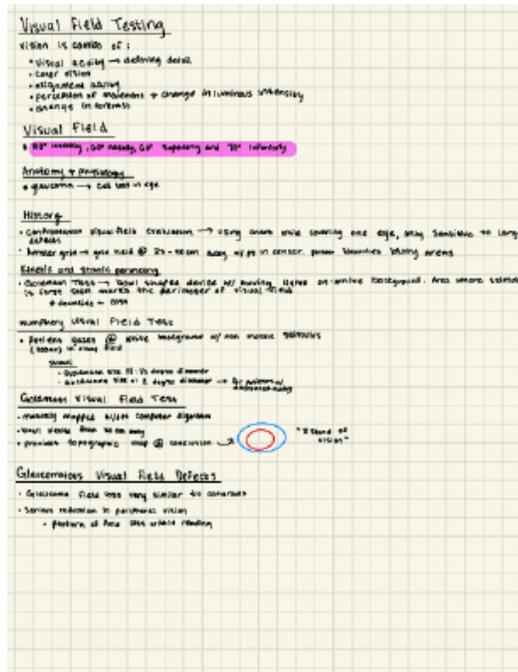
See attached notes

C. JN, "Visual Field Testing: From One Medical Student to Another," eyerounds.org, Aug. 21, 2013. <https://eyerounds.org/tutorials/VF-testing/#:~:text=The%20Visual%20Field> (accessed Sep. 12, 2023).

Conclusions/action items:

- Learn more about vision latitude/longitude and find ways to work standard visual field calculations into our balance device
- Use the Goldmann and Humphery Tests as guidelines when determining our stimuli
- Ask questions about the visual field to our client

ELLA LANG - Sep 12, 2023, 9:59 AM CDT



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Visual_Field_Testing.pdf (505 kB)



9/24 Rod Material and Specifications

Title: Telescoping Rod**Date:** 9/24/2023**Content by:** Ella Lang**Goals:**

- Determine categories for Design Matrix
- Find viable rod options with info on weights, material, etc.

Content:Categories for Design Matrix:

- Weight, less than 1 pound preferred
- Cost
- Tensile Strength
- Stable retractability
- Sterilizability with alcohol based cleaners

Material 1: Aluminum

1.

Aluminum is known to react with concentrated alcohol at high temperatures, however, at room temperature this reaction is very slow moving. the addition of water into alcoholic cleaning solutions can reaction [1].

Aluminum has a medium tensile strength based on the alloy.

- Option: https://www.amazon.com/Telescopic-Extension-Multi-Purpose-Mechanism-Lightweight/dp/B08GSP8FRY/ref=asc_df_B08GSP8FRY/?tag=hyprod-20&linkCode=df0&hvadid=475818854860&hvpos=&hvnetw=g&hvrnd=7370771912091943033&hvpone=&hvptwo=&hvgmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=pla-10961359010

1.

- 8.8 ounces
- 1.5-3 Feet

Material 2: PVC Plastic

Pvc plastic can be deformed with consistent alcohol cleaning use. However, by diluting the alcohol cleaner, the PVC material lasts much longer without being deformed [2].

- Tubing option: https://www.amazon.com/MECCANIXITY-20-5mm-Impact-Crafts-Sleeve/dp/B09J142LB6/ref=asc_df_B09J142LB6/?tag=hyprod-20&linkCode=df0&hvadid=652472721999&hvpos=&hvnetw=g&hvrnd=12037899283096840331&hvpone=&hvptwo=&hvgmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=901892065808930796&gclid=Cj0KCQjwvL-oBhCxARIsAHkOiu3aRzYYi7YQZnRSZ7Mob3C-8bsptlycTps2KUBeqZlfm6GTVmRi-BlaAmlYEALw_wcB&th=1

- 2.82 ounces
- 20.5mmx25mm

Material 3: Carbon fiber

Carbon fiber is often cleaned with strong alcohol mixtures, specifically bike parts according to many forums.

- Tubing option: https://www.racedayquads.com/products/1-meter-carbon-fiber-tube-1pc-choose-your-size?currency=USD&variant=31632520642673&gclid=Cj0KCQjwvL-oBhCxARIsAHkOiu3lZ8wuux8yArcljo_1hNW7FNpDFotOton4gWA7X-SQ6MJ2Q10ifgaAr4fEALw_wcB

- 7x5x1000 mm
- Fairly lightweight

Citations:

[1] Takashi Tsuchida, Corrosion Behavior of Aluminum by Mixed Alcohol Solutions, Zairyo-to-Kankyo, 2004, Volume 53, Issue 1, Pages 44-49, Released on J-STAGE December : ISSN 1881-9664, Print ISSN 0917-0480, <https://doi.org/10.3323/jcorr1991.53.44>, https://www.jstage.jst.go.jp/article/jcorr1991/53/1/53_1_44/article-char/en

[2] Yu, Qifeng & Selvadurai, Patrick. (2005). Mechanical behaviour of a plasticized PVC subjected to ethanol exposure. Polymer Degradation and Stability - POLYM DEGRAD ST 124. 10.1016/j.polymdegradstab.2005.01.007.

Conclusions/action items:

- Present option to the whole group on Tuesday and explain possible pros and cons of each
- Rank each option with Sarah



10/09 Telescoping Design w/ Spring Snap Clip

ELLA LANG - Oct 11, 2023, 1:44 PM CDT

Title: Telescoping Design w/ Spring Snap Clip

Date: 10/09

Content by: Ella Lang

Goals:

- Determine the method used for creating a telescoping rod with a spring-snapping mechanism

Content:

In document below

K. D. Tolliver, "How to Make a Telescoping Pole," Hunker. <https://www.hunker.com/12289946/how-to-make-a-telescoping-pole>

Conclusions/action items:

- Create plan for fabrication of telescoping pole

ELLA LANG - Oct 11, 2023, 1:44 PM CDT



[Download](#)

Untitled_Draft_.pdf (246 kB)



10/11 Telescoping Rod w/ Locking Clip

ELLA LANG - Oct 11, 2023, 1:50 PM CDT

Title: Telescoping Rod w/ Locking Clip

Date: 10/11

Content by: Ella Lang

Goals:

- Determine snap clips available on the market
- Identify methods of fabricating a rod with a snap clip mechanism

Content:

In document below

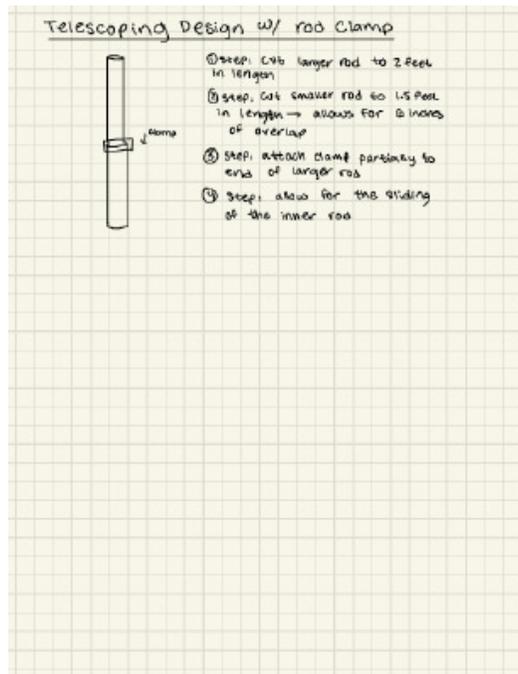
"PD 1.5-to-3 Foot Telescoping Extension Pole, Multi-Purpose Paint Roller Extension, EZ-Lock Mechanism | Lightweight Aluminum Handle | Threaded Pole for Window Squeegee, Feather Duster (1.5-3 Feet)," Amazon. https://www.amazon.com/Telescopic-Extension-Multi-Purpose-Mechanism-Lightweight/dp/B08GSP8FRY/ref=sr_1_1_sspa?keywords=Telescopic%2BPoles&qid=1697049161&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

keywords=Telescopic%2BPoles&qid=1697049161&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

Conclusions/action items:

- Plan out next steps in the fabrication process and present to the group

ELLA LANG - Oct 11, 2023, 1:48 PM CDT



[Download](#)

Telescoping_Designs.pdf (170 kB)



11/7 Rod Measurements- Sticker

ELLA LANG - Nov 08, 2023, 5:18 PM CST

Title: Rod Measurements

Date: 11/7/2023

Content by: Ella Lang

Goals:

- Determine whether Cricut vinyl or sticker strip off of Amazon makes more sense cost/time-wise
- Reduce friction between sticker and telescoping design of rod
- Pick a material that is durable and withstands frequent sanitization

Content:

Cricut vinyl: Created in the MakerSpace

- Small lines are difficult to produce, Cricut machine won't make them all exactly straight
- Causes friction with telescoping adjustments, which could cause small pieces of sticker to detach
- Hard to transfer, if one small sticker is not transferred correctly, the strip will be inaccurate
- Overall hard to fabricate, and requires meticulous design

Amazon Strip: https://www.amazon.com/100cm-Ruler-Sticker-Transparent-Centimeters/dp/B0C6NNLZQ5/ref=sr_1_2_sspa?crid=3TKLEDALUPCLP&keywords=sticker+ruler&qid=1699485166&srefix=sticker+ruler%2Caps%2C104&sr=8-2-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1

Conclusions/action items:



11/7 Rod Measurements- Engraving

ELLA LANG - Dec 03, 2023, 7:01 PM CST

Title: Rod Measurements- Engraving

Date: 11/7

Content by: Ella Lang

Goals:

- Create engraving file and process

Content:

Process for engraving measurements

1. Tape off plastic sections of the rod
2. Spray paint the rod with black spray paint(water soluble)
3. Ensure the file matches up
4. Calibrate laser cutter
5. Engrave (note: ceramic in spray paint will set and stay on the rod at measurement lines)
6. Wash off the remaining black spray paint with water

Conclusions/action items:

- This is the procedure for laser engraving

ELLA LANG - Dec 03, 2023, 7:02 PM CST



[Download](#)

Dynamic_Balance_Device_-_Laser_Etch_2.ai (1.22 MB)



2023/09/10 - Cognitive Task Training

Gianna Inga - Sep 10, 2023, 9:45 PM CDT

Title: Cognitive Task Training

Date: 2023/09/10

Content by: Gianna

Present: Gianna

Goals: To learn more about how cognitive task training impacts dynamic balance physical therapy.

Content:

- Patients had recently suffered a stroke and were participating in dynamic physical therapy to regain balance and gait ability
- Patients would do a physical task, touching their non-affected foot to a specific square
- Half the patients had a light to indicate their movement, The light was like a traffic light, green would indicate movement and which square to touch while red meant no movement
- The other half did the same movements but without the light indication
- What they found was that the patients who were instructed by the light, the cognitive task, improved in balance and ambulation significantly more than the patients who just did the motions
- Having a cognitive task associated with physical therapy with post-stroke patients was found to be more effective because the movements became unconscious and more nature

References:

S. Hong, Y. Moon, and J. Choi, "Effects of Cognitive Task Training on Dynamic Balance and Gait of Patients with Stroke: A Preliminary Randomized Controlled Study," *Med Sci Monit Basic Res*, vol. 26, pp. e925264-1-e925264-7, Aug. 2020, doi: [10.12659/MSMBR.925264](https://doi.org/10.12659/MSMBR.925264).

Conclusions/action items: This information helps us better understand the impact having a cognitive focus has on post-stroke physical therapy and can possibly implement it into our design. It also holds significance as it specifies different ambulation and balance tests as well as dynamic balance physical therapy exercises. We could possibly make the device light color changeable as well as the different numbers/symbols Mr. Kutschera wanted.



2023/09/13 - Ataxia

Gianna Inga - Sep 13, 2023, 4:05 PM CDT

Title: Ataxia

Date: 2023/09/13

Content by: Gianna

Present: Gianna

Goals: Better understand ataxia which is a condition some of the patients our client treats have.

Content:

- Ataxia is a condition in which people don't have full control of their limbs
- Their balance, coordination, and walking are greatly affected
- This condition can also cause slurred speech and slow eye movement
- It can be caused by stroke, tumors, alcoholism, nerve damage, metabolic disorders, vitamin deficiencies, and multiple sclerosis

Conclusions/action items: This helps to understand the patients our client treats and what they struggle with. We will have a good idea of who will be utilizing the device and the symptoms they will be battling when doing exercises with the device.

References: "Ataxia." <https://www.hopkinsmedicine.org/health/conditions-and-diseases/ataxia> (accessed Sep. 13, 2023).



2023/10/10 - Post Stroke Rehabilitation Recommendations

Gianna Inga - Oct 10, 2023, 10:17 PM CDT

Title: Post Stroke Rehabilitation Recommendations

Date: 2023/10/10

Content by: Gianna

Present: Gianna

Goals: Learn more about the recommended rehabilitation session time

Content:

- all the recommendations on how to treat a patient post-stroke
- explains how and what to screen and assess a patient for
- explains how to support emotionally and treat patients who suffered a stroke
- NICE recommends a minimum 45-minute session of rehabilitation therapy post-stroke, five times a week
- rehabilitation therapy: occupational therapy, physiotherapy, speech and language therapy
- if they can do more than 45 minutes it is recommended to go longer
- recommends repetitive tasks for rehabilitation

Conclusions/action items: We will keep the duration of the rehabilitation sessions in mind. To test out the device we want to simulate an as realistic as possible rehabilitation session and it's very important that we have the recommended session time. We will ask Dan how long each of the exercises he does to get a more accurate intended usage of the device.

References: "1 Recommendations | Stroke rehabilitation in adults | Guidance | NICE." Accessed: Oct. 10, 2023. [Online]. Available: <https://www.nice.org.uk/guidance/cg162/chapter/1-Recommendations#organising-health-and-social-care-for-people-needing-rehabilitation-after-stroke>



2023/09/11 - Light up devices

Gianna Inga - Sep 12, 2023, 1:54 PM C

Title: Light up devices

Date: 2023/09/11

Content by: Gianna

Present: Gianna

Goals: Explore different light-up devices for potential ideas.

Content:

- LED Stack Light: different colored light-up cylinders that are stackable and turn on individually

"Modular LED Signal Tower Stack Lights - 2.4" Diameter - Adjustable Mount with 50mm Pole - Red, Green - 24V." <https://www.superbrightleds.com/industrial-led-lighting/specialty-commercial-and-industrial/industrial-signal-lights-and-stacking-tower-lights/modular-led-signal-tower-stack-lights-2-4-diameter-adjustable-mount-with-50mm-pole+volts-24-VDC+color-Red-Green> (access Sep. 11, 2023).

- Push light-colored puck: light-up disk that is color changing through a remote

"HONWELL Push Light Colored Puck Lights Remote Controlled Battery Operated RGB Fairy Lights Wireless Touch Lights Tap Light Dimmable Closet Cabinet Lights, Stick Voice Level Lights Classroom - Amazon.com." https://www.amazon.com/HONWELL-Control-Operated-Wireless-Colors-Dimmable/dp/B07B2YLY6D/ref=asc_df_B07B2YLY6D/?tag=hyprod-20&linkCode=df0&hvadid=242082743678&hvpos=&hvnetw=g&hvrnd=16067016414450698306&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=436647068368&pvc=1 (accessed Sep. 11, 2023).

- mini beacon strobe light: orange light-up device with manual switch

"mini-AURA 4-Inch 4W LED Beacon Strobe Light - Amber," Jan. 10, 2018. <https://www.truemods.com/lamphus-mini-aura-aubl03-4w-led-warning-beacon-pszledstb2041-am> (accessed Sep. 11 2023).

- led flexible rectangle

"Amazon.com: [RGB & Breathing Pattern] Batman led Light Decorations Flexible Helmet Lights Cosplay DIY kit RGB Superhero for Men Gifts - Breathe Color Lights RGB : Clothing, Shoes & Jewelry." https://www.amazon.com/Breathing-Pattern-Decorations-Flexible-Superhero/dp/B09WMJW36W/ref=sr_1_3_sspa?crid=2BKTINXKM4GCN&keywords=mini%2Bled%2Blights%2Bstrip&qid=1694544643&prefix=mini%2Bled%2Blights%2Bstrip%2Ccaps%2C127&sr=8-3-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1 (accessed Sep. 12, 2023).

Conclusions/action items: These are a couple of light-up disks/devices we could implement into our product or take inspiration from when deciding how we want the light to function/look in a product.



2023/09/23 - Industrial Ergonomic Handle

Gianna Inga - Sep 23, 2023, 10:19 PM CDT

Title: Industrial Ergonomic Handle

Date: 2023/09/23

Content by: Gianna

Present: Gianna

Goals: To research ergonomic handles and to get a basic understanding of handles/grip

Content:

- Obtained information about the average American male hand size (a description our client matches)

40-Year-Old American Male for Year 2000: values in cm (inches)

Dimension	5th percentile	50th percentile	95th percentile
Hand length	17.9 (7.0)	19.3 (7.6)	20.6 (8.1)
Hand breadth	8.2 (3.2)	8.9 (3.5)	9.6 (3.8)
Hand circumference	20.3 (8.0)	21.8 (8.6)	23.4 (9.2)

- Stated Thermoplastic elastomer (TPE) is a material used for a better grip on tools - "similar to rubber, it has a tactile feel and provides a soft-touch grip"

- The video on the page, showed multiple different grips: round, ribbed, flat, and handle grips

- Grips are flexible and can stretch to fit diameters larger than itself

Conclusions/action items: I will look more into grips as that is the term most related to the product we want to create. I will also look into the TPE to see if it would be useful material to utilize and how we could implement it into the product. We will utilize the hand-size chart to make a grip that works best for our client.

References:

"What is an industrial ergonomic handle?" <https://www.essentracomponents.com/en-us/news/solutions/access-hardware/what-is-an-industrial-ergonomic-handle> (accessed Sep. 23, 2023)

Handles, Grips and Knobs | Essentra Components, (Nov. 16, 2020). Accessed: Sep. 23, 2023. [Online Video]. Available: https://www.youtube.com/watch?v=4ZBR5KQ_ChA



2023/09/23 - LED light remote dimensions

Gianna Inga - Sep 23, 2023, 10:51 PM CDT

Title: LED light remote control dimensions

Date: 2023/09/23

Content by: Gianna

Present: Gianna

Goals: Get the dimensions of an LED light remote control for a general idea

Content:

- 124 (L) × 56(W) × 6 (H) ± 0.2mm (4.88 in (L) x 2.20 in (W) x .24 in (H))

Conclusions/action items: The electronics team talked about using LED lights in the disk that would have a remote control. Now we have dimensions to start from to try and implement into the handle. Potential issues would be that if it was fully implemented into the handle, the sensor would be blocked, and we would have to have the remote not be flushed in the handle.

References:

"Amazon.com: SUPERNIGHT RGB LED IR Remote Controller DC12V 6A with 44 Keys IR Remote Control for SMD 5050 3528 2835 RGB LED Strip Lights : Tools & Home Improvement." <https://www.amazon.com/EPBOWPT-44Key-Remote-Controller-Lights/dp/B01KJ4VLYA?th=1> (accessed Sep. 23, 2023).



2023/09/23 - Bike flare design measurement

Title: Flare Bike Grip Designs

Date: 2023/09/23

Content by: Gianna

Present: Gianna

Goals: To explore flare bike grips on the market and their measurements

Content:

- [1] 1.96 in (W) x 5.11 in (L)

- .85 in diameter hole



- [2] 2.28 in (W) x 5.51 in (L)

- uses rubber for cushioning grey areas



Conclusions/action items: These serve as a reference we can base a design off of. These flare designs would have the width to accommodate the LED remote control within the handle.

References:

[1] "Bicycle Handlebar Grips Ergonomic Mtb Handle Cover," *SAVA Carbon Bike*. <https://savadeck-bike.com/products/bicycle-handlebar-grips-ergonomic-mtb-handle-cover> (accessed Sep. 24, 2023).

[2] "9.85US \$ 38% OFF|Rubber Mountain Bike Handlebar | Ergonomic Grips Handlebar | Ergonomic Bike Grips - Bicycle Grips - Aliexpress," *aliexpress.com*. https://www.aliexpress.com/item/3256804337928668.html?src=ibdm_d03p0558e02r02&sk=&aff_platform=&aff_trace_key=&af=&cv=&cn=&dp= (accessed Sep. 24, 2023).



2023/09/24 - AutoCAD handle designs

Gianna Inga - Sep 24, 2023, 12:18 AM CDT

Title: AutoCAD handle designs

Date: 2023/09/24

Content by: Gianna

Present: Gianna

Goals: Find AutoCAD designs that we could utilize as the base of our handle

Content:

- ski pole grip: we could utilize the finger grooves and measurements for our design, we would have to enlarge the width

- flare handlebar grip: we could utilize the design for the measurement and the base for our handle

Conclusions/action items:

References:

[1] "Ski pole grip | 3D CAD Model Library | GrabCAD." <https://grabcad.com/library/ski-pole-grip-1> (accessed Sep. 24, 2023).

[2] "Handlebar grip | 3D CAD Model Library | GrabCAD." <https://grabcad.com/library/handlebar-grip-2> (accessed Sep. 24, 2023).



2023/09/24 - wii remote dimensions

Gianna Inga - Sep 24, 2023, 4:57 PM CDT

Title: Wii remote dimensions

Date: 2023/09/24

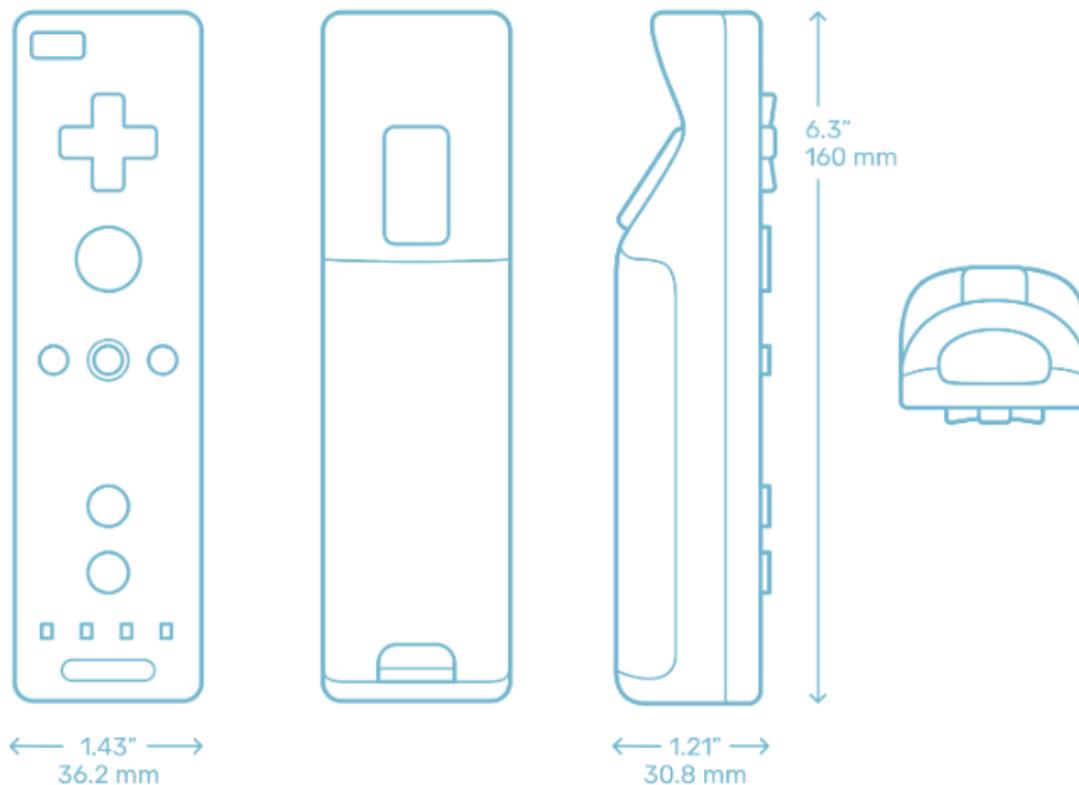
Content by: Gianna

Present: Gianna

Goals: document the wii remote dimensions

Content:

- 1.43" (36.2 mm) (W) x 6.3" (160 mm) (L) x 1.21" (30.8 mm) (H)



Conclusions/action items: We can use these dimensions and design to be one of the potential designs of the handle. It is nice because it shows the optimum spot to put buttons and triggers for the person holding it.

References:

"Wii Remote Dimensions & Drawings | Dimensions.com." <https://www.dimensions.com/element/wii-remote> (accessed Sep. 24, 2023).



2023/09/24 - Wii remotes autoCAD

Gianna Inga - Sep 24, 2023, 5:19 PM CDT

Title: Wii Remotes AutoCAD

Date: 2023/09/24

Content by: Gianna

Present: Gianna

Goals: Obtain Wii Remote autoCAD design

Content:

- Both the normal wii remote and nunchuk

Conclusions/action items: We can utilize these designs for our handle designs. The normal wii remote offers a larger flat surface in which can put buttons or the LED remote, it also already has buttons in the most optimum positions for user comfort. The nunchuk is similar as it has preplaced buttons for user comfort but it has more of a ergonomic design.

References:

"Wii Remote and Nunchuck | 3D CAD Model Library | GrabCAD." <https://grabcad.com/library/wii-remote-and-nunchuck-1> (accessed Sep. 24, 2023)



2023/09/25 - IR Remote dimensions

Gianna Inga - Sep 25, 2023, 6:21 PM CDT

Title: IR Remote dimensions

Date: 2023/09/25

Content by: Gianna

Present: Gianna

Goals: document dimensions of potential ir remote to incorporate

Content:

Remote 1: 39.6mm (1.56in) x 85.7mm (3.37in)

Remote 2: 40mm (1.57in) x 86mm (3.39in)

Conclusions/action items: Use these dimensions as a reference when thinking of how to incorporate them into the handle.

References: "Amazon.com: Alinan Infrared IR Remote Control Sensor Module Kits, 17-Key+21-Key Controller and Receiver with Cable for Arduino : Electronics." Accessed: Sep. 25, 2023. [Online]. Available: https://www.amazon.com/Alinan-Infrared-Control-Controller-Receiver/dp/B0C4Y5245T/ref=sr_1_8?keywords=infrared+remote+control&qid=1694994244&sr=8-8



2023/09/27 - Sources for Design Matrix

Gianna Inga - Sep 27, 2023, 3:36 PM CDT

Title: Sources for Design Matrix

Date: 2023/09/27

Content by: Gianna

Present: Gianna

Goals: Document the sources for the Design Matrix

Content:

Wii remote autocad: "Nintendo Wii Remote (Wiimote) | 3D CAD Model Library | GrabCAD." Accessed: Sep. 27, 2023. [Online]. Available: <https://grabcad.com/library/nintendo-wii-remote-wiimote-1>

PLA density: "All About the Density of PLA," All3DP. Accessed: Sep. 27, 2023. [Online]. Available: <https://all3dp.com/2/pla-density-what-s-the-density-of-pla-filament-plastic/>

Gym grip: "McMaster-Carr." Accessed: Sep. 27, 2023. [Online]. Available: <https://www.mcmaster.com/>

3D cost estimator: "3D Printer Cost Calculator," UW Makerspace. Accessed: Sep. 27, 2023. [Online]. Available: <https://making.engr.wisc.edu/3dprint-cost/>

Conclusions/action items: Used these sources in the design matrix and needed to document them.



2023/10/05 - Preliminary Presentation Picture Links

Gianna Inga - Oct 05, 2023, 9:49 PM CDT

Title: Preliminary Presentation

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items:



2023/10/10 - Formlabs Flexible 80A resin

Gianna Inga - Oct 10, 2023, 10:29 PM CDT

Title: Formlabs Flexible 80A resin

Date: 2023/10/10

Content by: Gianna

Present: Gianna

Goals: Understand the specifications of formlabs flexible 80A resin

Content:

- soft-touch
- Tear strength: 24kN/m
- Durometer/Shore hardness: 80A
- tensile strength: 8.9 MPa
- cures, so it is watertight

Conclusions/action items: All these specifications in mind are why we chose formlabs flexible 80A resin to be the intended material for one of the handle designs. For a design we wanted to 3D print, formlabs flexible 80A resin was the best option as it gave flexibility for increased hand grip and it would be watertight. Pla wouldn't be watertight and one of the reasons we didn't choose it for the design as the device will be wiped down multiple times a day.

References: "Formlabs Customer Support," Formlabs Customer Support. Accessed: Oct. 10, 2023. [Online]. Available: https://support.formlabs.com/s/article/Using-Flexible-Resin?language=en_US



2023/10/25 - Lens

Gianna Inga - Oct 25, 2023, 12:28 PM CDT

Title: Lens

Date: 2023/10/25

Content by: Gianna

Present: Gianna

Goals: If we were to implement a lens to the product, which lens would we need and how could we figure out where to put it to magnify the display

Content:

- Projectors use a convex lens
- Convex lens creates an image bigger than the object
- Concave lens creates an image smaller than the object
- Convex converges all the parallel light into a focal point where the image is formed
- Convex lenses are thicker in the middle
- Lens formula:

$$1/f = 1/v - 1/u$$

- u = object distance
- v = image distance
- f = focal point
- magnification formula:

$$h(\text{image}) / h(\text{object}) = v/u$$

- h = height

Conclusions/action items: We can use a convex lens in our device to make the image of the display bigger than 1.28". We could project the image on a translucent cover. This way we could utilize the 1.28" display while also making it able to be seen by older patients.

References:

"Why Projectors Use Convex Lens? - Theater Desire." Accessed: Oct. 25, 2023. [Online]. Available: <https://theaterdesire.com/why-projectors-use-convex-lens/>

"Magnification formula for lenses (video) | Khan Academy." Accessed: Oct. 25, 2023. [Online]. Available: <https://www.khanacademy.org/science/in-class10th-physics/in-in-10th-physics-light-reflection-refraction/in-in-lens-formula-magnification/e/convex-and-concave-lenses>



2023/11/11 - SolidWorks feature research

Gianna Inga - Nov 11, 2023, 3:35 PM CST

Title: SolidWorks Feature Research

Date: 2023/11/11

Content by: Gianna

Present: Gianna

Goals: Figure out how to implement a hole and extrude on the side of a cylinder

Content:

- the wrap feature, which can be found under the features tab, takes a sketch on a plane and wraps it onto the selected surface [1]
 - this worked to put the sketch on the edge of the cylinder, however, I still couldn't use the wrapped sketch to cut a hole or extrude off the side
- using the hole wizard, a hole can be placed on the side of the cylinder and centered by using smart dimensions [2]
 - this method successfully created a hole in the disk side
- the video shows creating a reference plane where you want the extrude to end and extrude the sketch up to the cylinder surface
 - this method successfully created the extruding cylinder on the cylinder surface

Conclusions/action items:

References:

- [1] "Wrap - 2021 - SOLIDWORKS Help." Accessed: Nov. 11, 2023. [Online]. Available: https://help.solidworks.com/2021/english/SolidWorks/sldworks/HIDD_DVE_SURF_WRAPPING_SKETCH.htm
- [2] N. Marsh, "Using Hole Wizard on a Curved (Cylindrical) Surface," Computer Aided Technology. Accessed: Nov. 11, 2023. [Online]. Available: <https://www.cati.com/blog/using-hole-wizard-on-a-curved-cylindrical-surface/>
- [3] *Extrude on Cylindrical Surface*, (Jul. 07, 2020). Accessed: Nov. 11, 2023. [Online Video]. Available: <https://www.youtube.com/watch?v=5eHxlpMeESI>



2023/11/10 - Tong Distinguished Presentation

Gianna Inga - Nov 10, 2023, 12:29 PM CST

Title: Tong Distinguished Presentation

Date: 2023/11/10

Content by: Gianna

Present: Gianna

Goals: Understand the speaker's story and learn from her mistakes and successes

Content:

- inspired by a heart bypass machine
- passion to help people and be involved in medicine, wanted to do things
- leadership and teamwork
- graduate school, teaching people complicated research
- after college, things got a little crazy and not linear
- went to med school, didn't match for residency, failed
- now is a health equity director

advice:

- find your people
- do things that scare you
- laugh until you cry, cry until you laugh

Conclusions/action items: Understand that everything in life is not linear. You may fail, but failures are an opportunity to pivot and find a different path.



2023/09/12 - Coded LED strip grid

Gianna Inga - Sep 12, 2023, 5:21 PM CDT

Title: Coded LED strip grid

Date: 2023/09/12

Content by: Gianna

Present: Gianna

Goals: Explore different ideas for light display on the product

Content:

- This project uses the common LED light strip placed in a grid to make a display
- It shows the step by step on how to code the grid and how to build this display

Conclusions/action items: We could make a smaller scale version of this for our light-up display as it could change color and we could code it to show numbers.

References:

J. Bruce, "Weekend Project: Build a Giant LED Pixel Display," *MUO*, Feb. 03, 2015. <https://www.makeuseof.com/tag/weekend-project-build-giant-led-pixel-display/> (accessed Sep. 12, 2023).



2023/09/13 - Brainstorm Design Idea #1

Gianna Inga - Sep 13, 2023, 4:39 PM CDT

Title: Brainstorm Design Idea # 1

Date: 2023/09/13

Content by: Gianna

Present: Gianna

Goals: Start thinking about ideas for the design of the device.

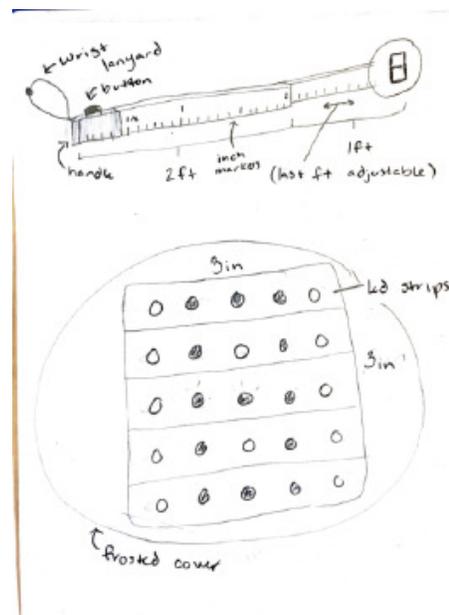
Content: See attached for the design

- Showcases a changeable length rod marked with inch marks

- The light-up part is made up of LED strips organized in a grid and covered with a frosted cover to blend the light into a recognizable number

Conclusions/action items: Share design ideas at brainstorm meeting with team.

Gianna Inga - Sep 13, 2023, 4:39 PM CDT



[Download](#)

bme_200_design_1.pdf (319 kB)



2023/10/19 - Rod prototype

Gianna Inga - Oct 19, 2023, 10:07 AM CD

Title: Prototype Rod

Date: 2023/10/19

Content by: Gianna

Present: Simon, Ella, Shriya, Maggie, Sarah

Goals: Find a rod to purchase and move forward with prototyping

Content:

- At first, we had wanted a carbon fiber rod because of its lightweight and strong design
- However, we found that trying to get a carbon fiber rod with a minimum and max close to 2ft-3ft was nearly impossible without getting it custom-made
- We did look at carbon fiber selfie sticks, however, we didn't like how many sections those had as it would be difficult to implant an accurate measuring device on it, we also didn't like how sm: they compacted to
- I found this aluminum painter's expandable rod
- We discussed changing to aluminum and talked to the rod team about their research and their advice, they said aluminum was only a little bit heavier than carbon fiber
- The product I found was expandable from 1.5 ft to 3 ft, which was very comparable to our requirements and estimated \$100 cheaper than a custom-made carbon fiber rod
- It also has a universal twist-on metal tip that we can attach the disk to
- We decided to order the painter's rod at least to start prototyping with, it is a lot cheaper, available fast, and meets the length requirements

Conclusions/action items: A carbon fiber rod can be bought and implemented in later versions of the device. However, for progress and prototyping purposes right now, we will move forward with an aluminum painter's rod.

References: "Amazon.com: 1.5-3 ft Long Paint Roller Extension Pole // Multi-Purpose Telescopic Extension Pole with Universal Twist-on Metal Tip // Lightweight & Sturdy Extendable Pole for Painting Dusting and Window Cleaning : Tools & Home Improvement." Accessed: Oct. 19, 2023. [Online]. Available: https://www.amazon.com/Extension-Multi-Purpose-Telescopic-Lightweight-Extendable/dp/B08LL28XZW/ref=asc_df_B08LL28XZW/?tag=hyprod-20&linkCode=df0&hvadid=647362015133&hvpos=&hvnetw=g&hvrnd=8124650800021733623&hvpone=&hvpw=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9018948&hvtargid=p1400458044709&gclid=CjwKCAjwp8OpBhAFEiwAG7NaEtJDgZJwi4u_MK1or8MnfwlgBBm_WT9_agruf1EPIDnsgy9--PDwCxoCRFgQAvD_BwE&th=1



2023/10/25 - Display coding

Title: Display coding

Date: 2023/10/25

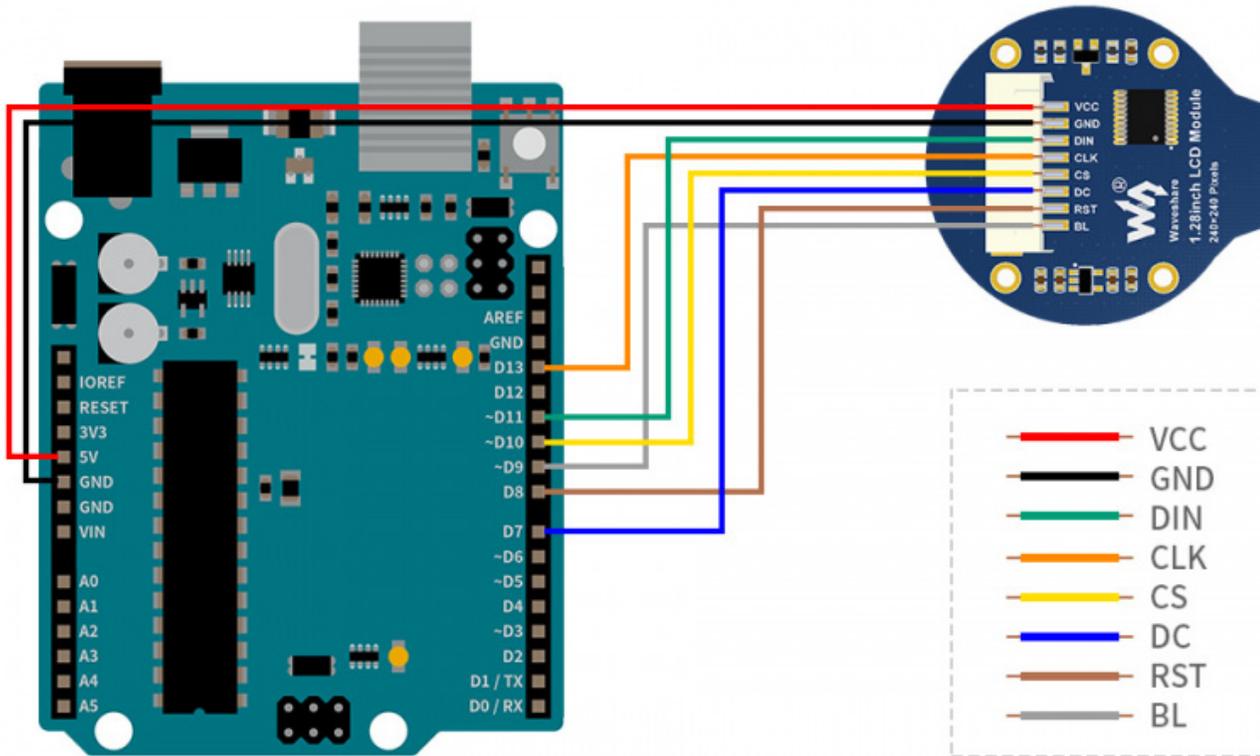
Content by: Gianna

Present: Gianna

Goals: Get an idea of what coding the display will entail and what code is already available

Content:

- For the 1.28-inch LCD display, Arduino is compatible
- The Waveshare website has Arduino code for the display
- It also has RaspberryPi and STM32 code
- It includes different size fonts
- images can be displayed
- "the program is divided into bottom-layer hardware interface, middle-layer LCD screen driver, and upper-layer application"
- Underlying hardware interface:
 - write pin level: void DEV_Digital_Write(int pin, int value)
 - read pin level: int DEV_Digital_Read(int pin)
- The displays can be delayed
- Upper Application:
 - you can draw pictures and display Chinese and English characters
 - you can also flip and rotate an image
 - there is also the ability to draw shapes like a rectangle and circle
 - can also display ascii characters and numbers



LCD	UNO
VCC	5V
GND	GND
DIN	D11
CLK	D13
CS	D10
DC	D7
RST	D8
BL	D9

Conclusions/action items: This is an incredible resource for us moving forward with fabrication. We will use the code to begin coding the display and utilize the tools in it. The ability to display numbers, letters, and characters is something we will utilize as the client wanted symbols or numbers to be displayed as well as colors. The rotation ability is also useful as the display will be turned upside down when on the left side of the patient, so we will need to rotate the symbols and text to be legible on both sides of the patient.

Resources: "1.28inch LCD Module - Waveshare Wiki." Accessed: Oct. 25, 2023. [Online]. Available: https://www.waveshare.com/wiki/1.28inch_LCD_Module



2023/10/25 - 3.4" Display

Title: 3.4" Display

Date: 2023/10/25

Content by: Gianna

Present: Gianna

Goals: Document another display option and its pros and cons

Content:

- 3.4" DSI Round Touch Display

- Waveshare brand

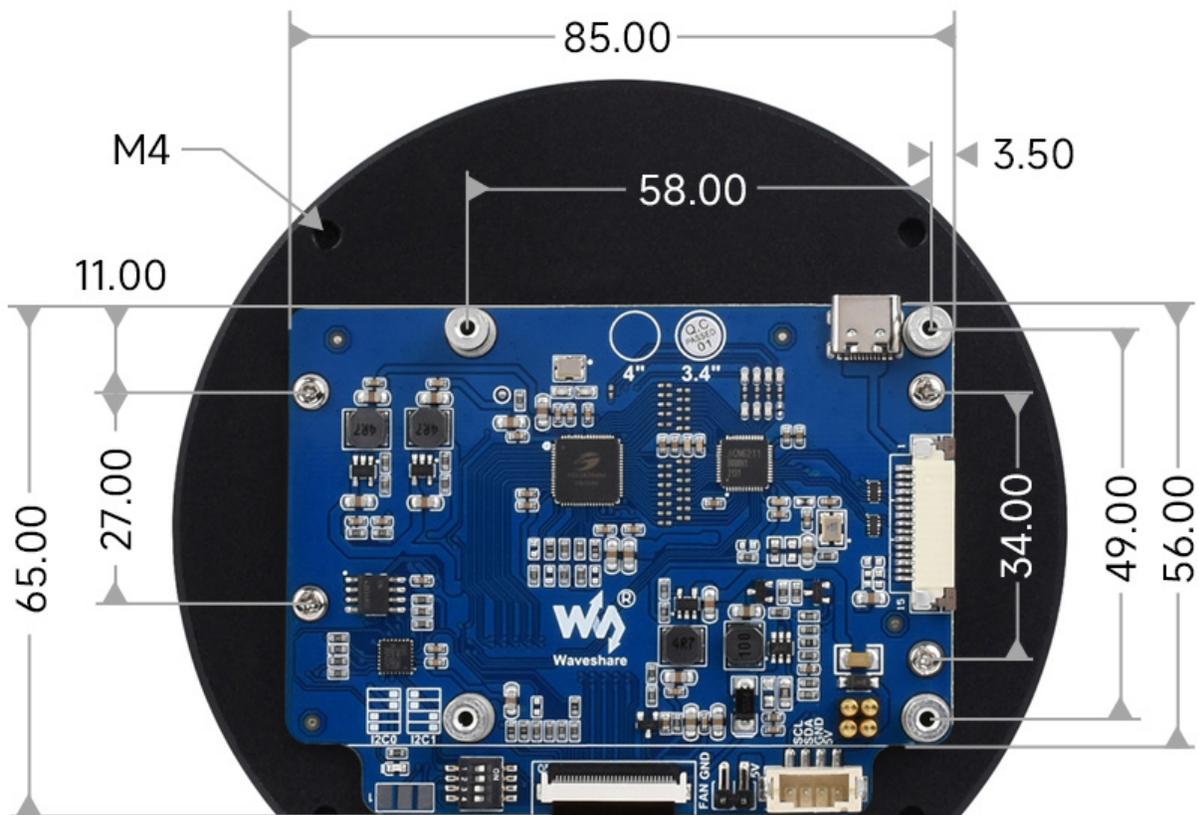
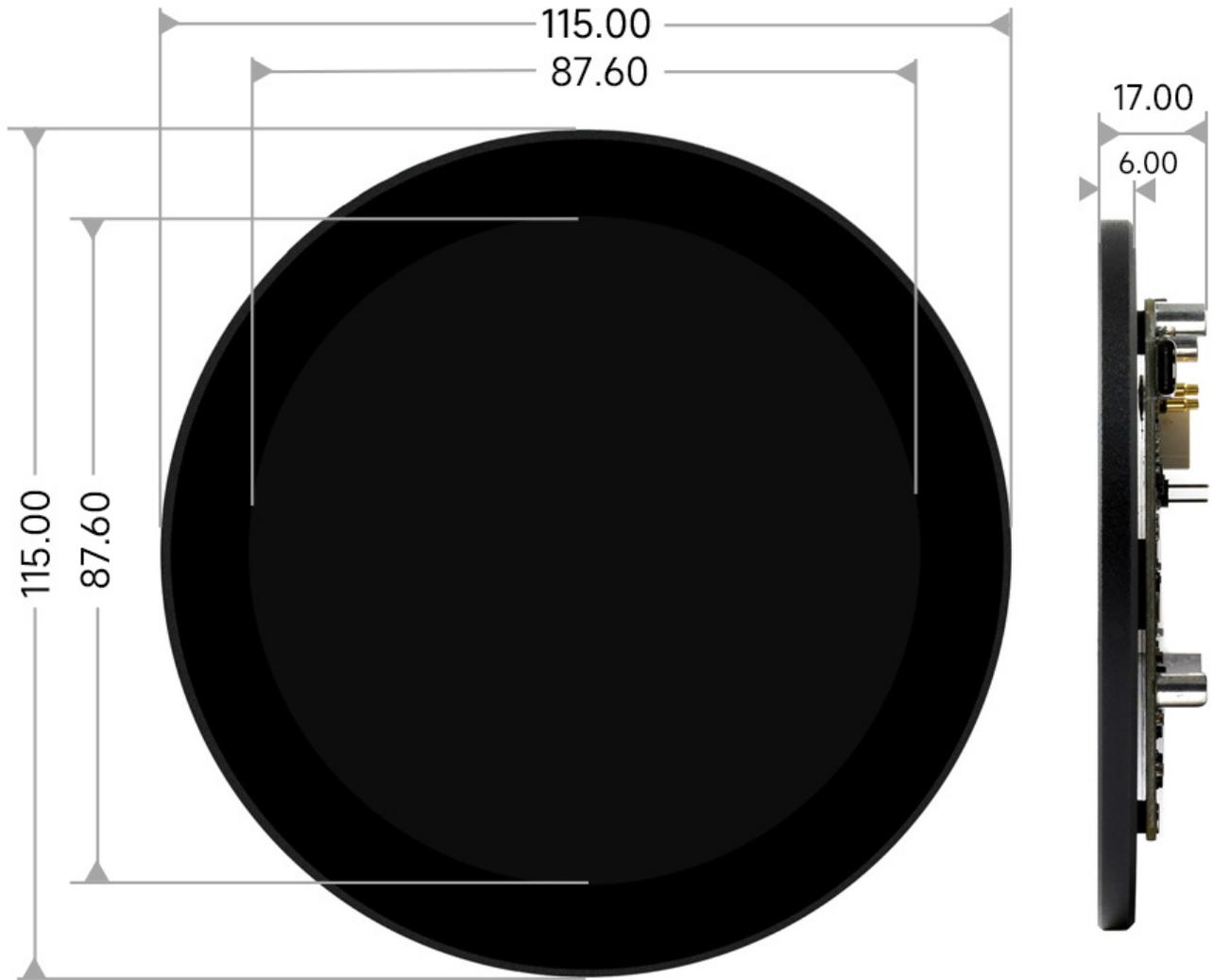
- \$84.99

- Viewing angle is 170 degrees

- 10 point touch

- 800x800 Resolution

- Only supports Rasberry Pi



Conclusions/action items: This is another option for the display, one that is closer to the desired size. However, it is only compatible with Raspberry Pi and is a lot more expensive than the 1.8" screen. I will bring up this option in the group meeting but accounting for our unfamiliarity with Raspberry Pi and the expense, we may still go forward with the smaller display for our first prototype and this may be an option we come back to in future prototypes.

References: "3.4inch DSI Round Touch Display, 800 × 800, IPS, 10-Point Touch | 3.4inch DSI LCD (C)." Accessed: Oct. 25, 2023. [Online]. Available: <https://www.waveshare.com/3.4inch-dsi-lcd-c.htm>



2023/10/30 - Disk back design

Title: Disk Back Design

Date: 2023/10/30

Content by: Gianna

Present: Gianna

Goals: Think of potential designs for the back of the disk to make it accessible

Content:

- slidable back (seen in remotes)



- click in back



- screwable lid (only works if the disk is circular)
- latch box

Conclusions/action items: I will bring these ideas to the disk meeting tonight. Hopefully, we can implement one of the designs into the disk so that we can access the inside from the back of the disk. It is important to be able to access it if a wire becomes unhooked or the display needs replacing.

References:

[1] "Universal Remote Control for All LG Smart TV LCD LED OLED UHD HDTV Plasma Magic 3D 4K TVs AKB74915305 50UH5500 50UH5500-UA 65UH6150," Walmart.com. Accessed: Oct. 30, 2023. [Online]. Available: <https://www.walmart.com/ip/Universal-Remote-Control-for-All-LG-Smart-TV-LCD-LED-OLED-UHD-HDTV-Plasma-Magic-3D-4K-TVs-AKB74915305-50UH5500-50UH5500-UA-65UH6150/480293936>

[2] "8.25US \$ 28% OFF|IR 433MHz Replacement TV Remote Control 3D DVD Player AKB72915244 Fit for LG 32LV2530 / 22LK330 / 26LK330 / 32LK330|Remote Controls| - AliExpress," aliexpress.us. Accessed: Oct. 30, 2023. [Online]. Available: https://www.aliexpress.com/item/2251832813470157.html?src=ibdm_d03p0558e02r02&sk=UneMJZVf&aff_platform=aaf&aff_trace_key=07b56d081a434886889cfa360074b70-1698685860575-03979-UneMJZVf&af=&cv=&cn=&dp=



2023/11/1 - SolidWorks disk v.1

Gianna Inga - Nov 02, 2023, 10:35 AM CDT

Title: SolidWorks disk v.1

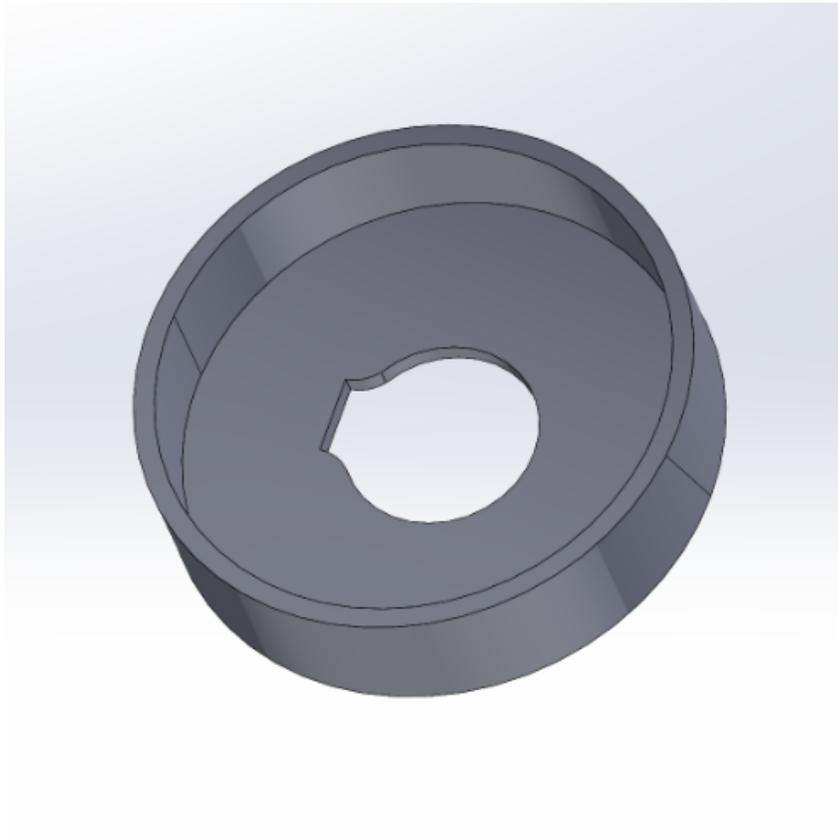
Date: 2023/11/1

Content by: Gianna

Present: Sarah, Shriya

Goals: Create and print the first version SolidWorks drawing of the disk

Content:



- outer circle: 4in diameter

- inner circle: 3.7in diameter

- hole: 1.4010in diameter

Conclusions/action items: Under Sarah's notes should be the intricate measurements of the display and this disk drawing. We designed it so the display would fit in the hole and be seen on the other side. The disk is to keep the Arduino, wires, and display all together, have a clean finish, and can be attached to the pole. We plan to redesign this to be like a jar container, a screwable back to easily access the inside but keep everything inside.



2023/11/9 - Disk v. 2

Title: Disk v. 2

Date: 2023/11/9

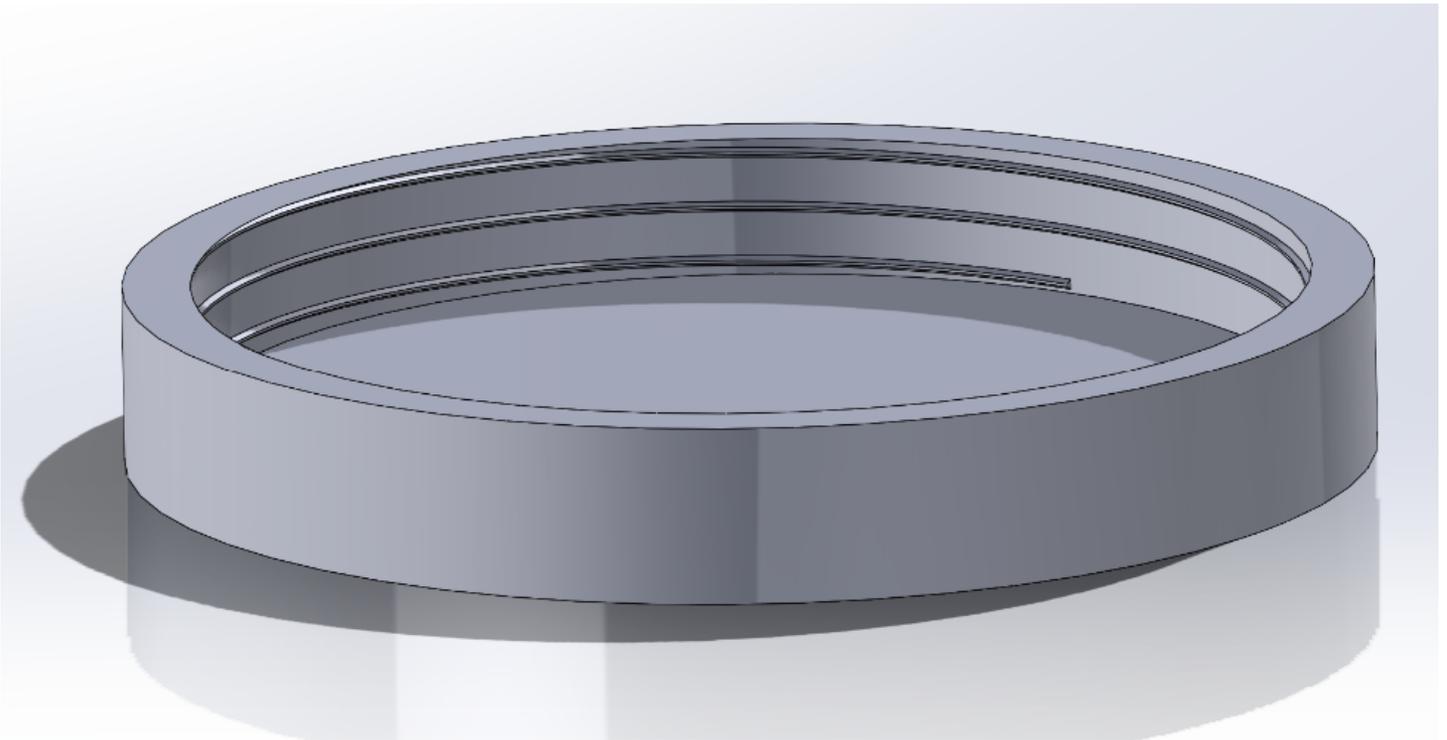
Content by: Gianna

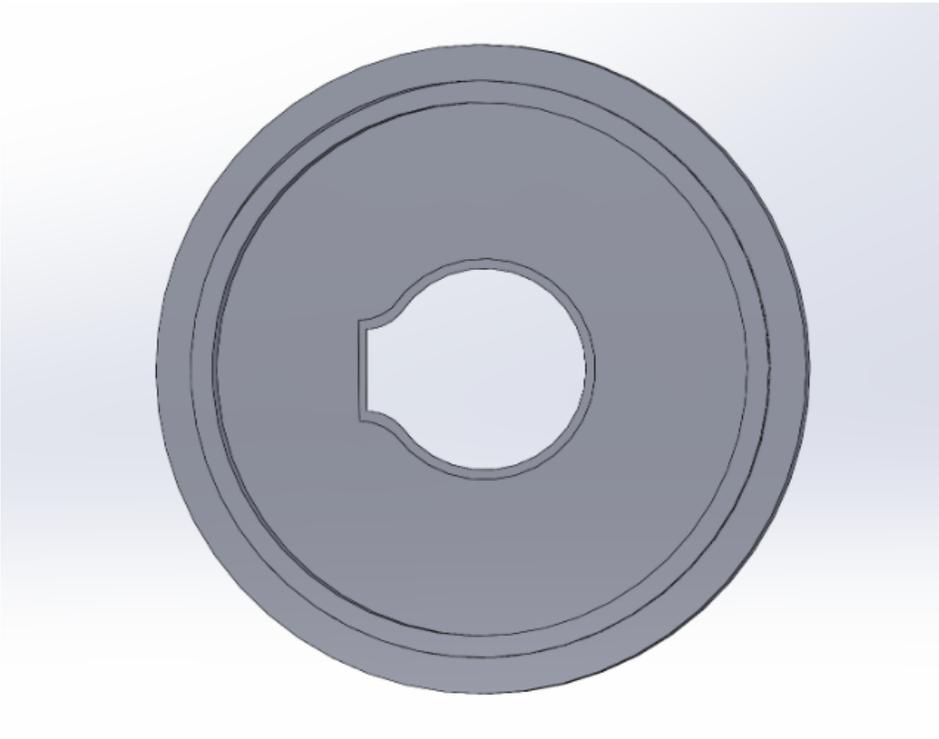
Present: Gianna

Goals: To redesign the disk so the display will sit more flush with its hole and to create a screw-top lid

Content:

- we created a lip around the previous hole in the disk and now the display will sit .15in from the outer surface of the disk
- we implemented threads in both the lid and base for the screwing effect
- we figured out that the top and bottom both need to have the same right-hand or left-hand threads
- I also created an assembly of both parts and ran an interference detection test until there was no interference and both parts were ensured to fit together





Conclusions/action items: We will modify the disk again but this is the version that creates the modifications we wanted. We will add an attachment piece, a cap that will attach to the pole. The attachment will be hollow so we can directly feed wires straight through the pole.



2023/12/2 - Disk v. 3

Gianna Inga - Dec 04, 2023, 1:29 PM CST

Title: Disk design v. 3

Date: 2023/12/2

Content by: Gianna

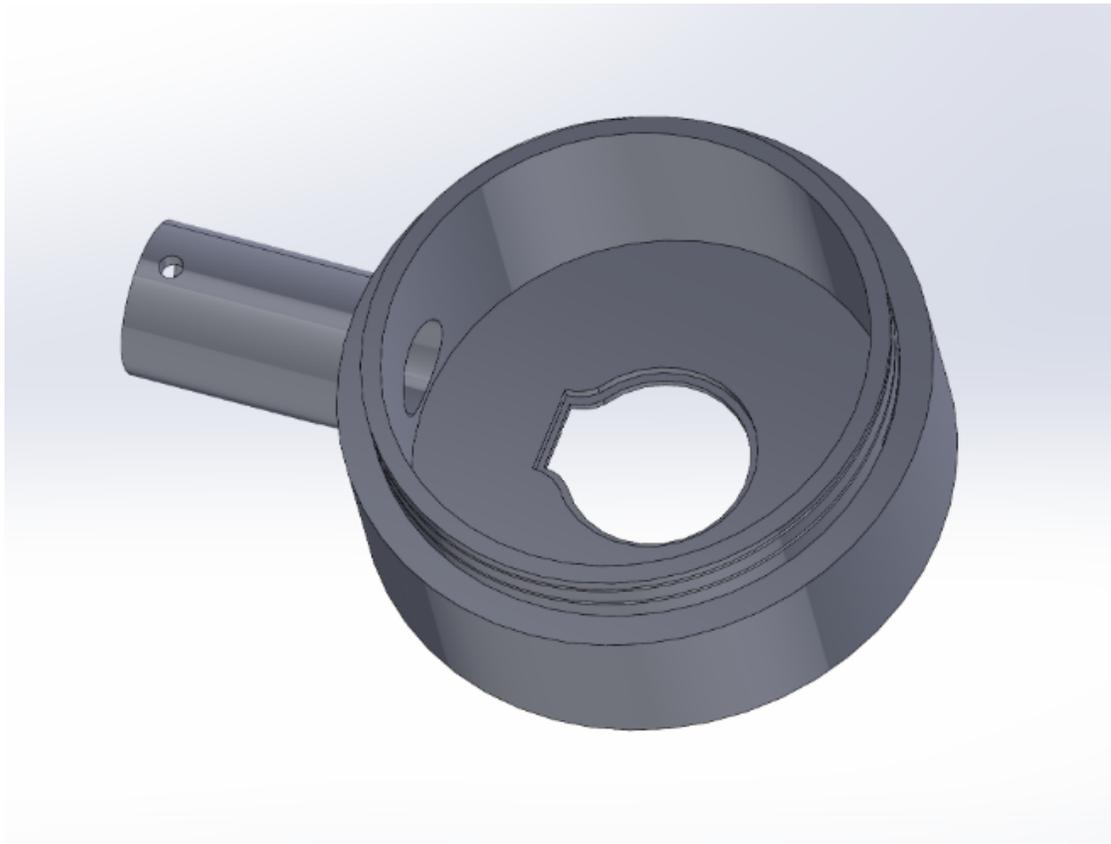
Present: Gianna

Goals: Document redesign of the disk

Content:

Changes:

- extrude on the side of the cylinder lowered to be flush with the bottom so it wouldn't need to have supports
- The inner diameter of the side extrude was increased to better accommodate the rod
- reprinting was also needed because v. 2 was printed wrong because of incorrect placement on the 3d printer



Conclusions/action items: We printed v. 3 and it came out better and is being used in the prototype. Further improvements would include improving the screwing system of the lid, right now if one keeps screwing, the lid will unscrew. Looking into other designs may be useful, maybe using tiny screws to secure the back.



2023/12/1 - Counterweight idea

Gianna Inga - Dec 02, 2023, 6:21 PM CST

Title: Counterweight idea

Date: 2023/12/1

Content by: Gianna

Present: Everyone

Goals: Find a counterweight to possibly put on the end of the rod

Content:

- lead fishing weights
- fishing rod counterweight
- baseball bat swing weight
- steel plates for weighted vests

Conclusions/action items: We ordered the lead fishing weights to hopefully implement into the handle to act as a counterweight for the disk.



Title: Spatial neglect syndrome

Date: 9/12/2023

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: To learn more about spatial neglect syndrome in stroke patients

Content:

-commonly caused by unilateral brain injury, found to be more severe in cases of right hemisphere brain damage (due to the right hemisphere's importance to attentional processes). can be the result of neurodegenerative disease, neoplasia and trauma, though most commonly resulting from hemispheric strokes

-patients have trouble with spatial awareness and responding to/perceiving stimuli on the contralesional side, patients may skew their gaze towards the side of the lesion, exhibit personal neglect to one side (eating one side of a plate, shaving one side of face, etc), exhibit motor neglect (not using contralesional limb even with no signs of weakness) overall bias towards the ipsilesional space

-neglect v extinction, both conditions can coexist in patients post stroke, visual extinction being where a patient fails to respond to a contralesional stimulus when a ipsilesional stimulus is also present (contralesional being on the opposite side of lesion, ipsilesional being on the same side)

-physical therapy treatments focus on reorienting the patients attention to the neglected side, encouraging exploration of the neglected side through visual cues and stimuli, however, due to neglect's variance from patient to patient, there has yet to be one clear treatment to aid in recovery

References: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4602245/>

K. Li and P. A. Malhotra, "Spatial neglect," *Practical Neurology*, vol. 15, no. 5, pp. 333–339, May 2015, doi: <https://doi.org/10.1136/practneurol-2015-001115>.

Conclusions: spatial neglect can be an aftereffect of a stroke, causing the patient to have a limited/lack of response to stimuli on their contralesional side (typically the left). It is typically treated through rehabilitating physical therapy encouraging attention to the patient's neglected side. We will be designing a device which will aid physical therapists in this treatment method of neglect.



Title: Association of neglect and balance

Date: 9/12/2023

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: To better understand the relationship between spatial neglect syndrome and balance

Content:

-visuospatial neglect has been found to be associated with limited independence while sitting, asymmetric posture, and weight bearing asymmetry during standstills. during movement, patients typically deviated to one side from the path

-overall, stroke survivors suffering from visuospatial neglect showed deviations in movement and posture to one side, impacting patient balance and daily life, due to the heterogeneity of the research results there is still a lack of evaluation of the mechanisms VSN and mobility

-balance relies on visual, vestibular, and somatosensory information to be sent to the central nervous system, in stroke patients this is impaired within 83% of stroke survivors. lack of balance can lead to immensely decreased quality of life, for fear of falling, injury, mobility troubles, etc. effective rehabilitation therapies being crucial to a patients livelihood

References: <https://pubmed.ncbi.nlm.nih.gov/33152521/>

E. Embrechts *et al.*, "The association between visuospatial neglect and balance and mobility post-stroke onset: A systematic review," *Annals of Physical and Rehabilitation Medicine*, vol. 64, no. 4, p. 101449, Jul. 2021, doi: <https://doi.org/10.1016/j.rehab.2020.10.003>.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6661695/>

J. Li *et al.*, "Rehabilitation for balance impairment in patients after stroke: a protocol of a systematic review and network meta-analysis," *BMJ Open*, vol. 9, no. 7, p. e026844, Jul. 2019, doi: <https://doi.org/10.1136/bmjopen-2018-026844>.

Conclusions/action items: Spatial neglect is closely tied to the balance abilities of stroke survivors, a lack of attention to one side leading to asymmetry in posture and movement causing patients to be unstable and at risk. Therapies coupling balance practice and stimulation of the neglected side of a stroke patient are commonly used as physical rehabilitation methods.



Competing Designs for Poster Presentation

SARAH RAUBENSTINE - Dec 09, 2023, 4:47 PM CST

Title: Competing Design Research for Poster

Date: 12/2/23

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: Compile information about competing devices

Content:

1. Dan's current design: the meter stick with colored dot at the end. This device leads clients through very similar testing to our device as it is the main point of inspiration, however lacks professionally and ability to change colors of the dot on end. No room for further improvements as our is such as coding shapes and symbols etc. Average cost is around five dollars for materials.

2. The Selfie Stick: This device is clearly made for entirely different field, not being tailored to the physical therapy practices that our dynamic balance device is. However, the telescoping rod design of the selfie stick as well as the ability to control the screen on the end with a button on the handle serves as slight inspiration for our final design. These come 20-40 dollars.

3. Bioness Integrated Therapy System: Provides a variety of interactive touch screen activities for patients to improve coordination, reaction time, reach, and depth perception. However, requires the patient to stand in place, not allowing these tests to take place along with movement. Our device allows therapists to lead patients through activities while stagnant or mobile, which the the BITS device does not have capacity for. This device costs upwards of 10,000 dollars. [1]

Conclusions/action items: Integrate these competing designs into poster and find images to enhance audience comprehension.

References: [1] "Bioness Integrated Therapy System (BITS)," *Brooks Rehabilitation*. <https://brooksrehab.org/technology/bits/>



SARAH RAUBENSTINE - Sep 13, 2023, 11:43 PM CDT

Title: Initial research of potential materials

Date: 9/13/2023

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: Begin a list of materials to use in design

Content:

-telescoping measuring rods, collapsable to more compact length, have inches to depict rod length used, can be helpful to quantify exercises

-client wanted to be able to display different colors and if possible numbers on the end of rod, we could attach a light grid to the end and preset numbers and basic colors into a remote control for the client to use while with patients, needs to be able to change colors and numbers without moving or collapsing the stick (could attach remote to base of rod for easy access during patient exercises)

-need to keep design lightweight so it can be easily handled with one hand as client will need to be readily available to stabilize patients, many of the rods found online are very large, will need to look for something shorter and easier to handle

Conclusions/action items: Need to look for easily accessible and easy to handle tools for the design, while still keeping it effective and functional for the client. Also need to keep into consideration the exercises the client will be using the device for so we can not only cover all needed uses but also allow ease of usage for all different possibilities.



Rod Material Notes

SARAH RAUBENSTINE - Sep 28, 2023, 8:31 PM CDT

Title: Rod Material Notes

Date: 9/27

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: Gather information about different materials to use for the rod and fill our design matrix

Content:

Matrix Categories: Weight, Tensile Strength, Ability to be sterilized, Cost, Ease of Fabrication

Aluminum: 3/5 weight - 2.7 g/cm³ density, pretty lightweight material; 3/5 tensile strength - 90-690 megapascals, dependable for our usage, not as stress resistant as carbon fiber; sterilizability 3/5 - degrades with high concentration alcohols in high temperate conditions, most likely would be fine to steralize for the intended use however; 4/5 cost-most of the aluminum rods range from 10-30 dollars, well within our budget; 5/5 ease of fabrication-many readily available telescoping aluminum rods, would not have to be assembled by the team

Carbon Fiber: 4/5 weight-1.8 g/cm³ density, very lightweight material especially considering its strength and durability; 5/5 tensile strength- 2500-7000 megapascals, very durable material, high resilience to stresses, would be very durable for this usage; 5/5 sterilizability -no degradation with alcohol based cleaners; 2/5 cost-most expensive of the assessed materials; 2/5 ease of fabrication-we would have to assemble it to be collapsible

PVC: 5/5 weight-1.4 g/cm³, very lightweight material, lightest out of the three options; 2/5 tensile strength-weakest of the three materials, 52 megapascals in strength, the lightness is counterbalanced by being susceptible to stress; 3/5 sterilizability -degradation with some stronger cleaners and frequent scrubbing would alter the coating; 5/5 cost-very affordable, 10-20 for tubing, most affordable option; 2/5 ease of fabrication-would require assembly by the team

Conclusions/action items: Carbon fiber had the greatest advantage within the matrix

References:

“MatWeb - The Online Materials Information Resource,” *www.matweb.com*. <https://www.matweb.com/search/datasheet.aspx?bassnum=AMEAL00&ckck=1#:~:text=Aluminum%20is%20a%20silver%2Dcolored> (accessed Sep. 28, 2023).

“Is an alcohol-based spray cleaner ok for cleaning an aluminum heat exchanger?,” *Chemistry Stack Exchange*. <https://chemistry.stackexchange.com/questions/107468/is-an-alcohol-based-spray-cleaner-ok-for-cleaning-an-aluminum-heat-exchanger#:~:text=Simple%20alcohols%20such%20as%20ethanol> (accessed Sep. 28, 2023).

“Polyvinyl Chloride PVC,” *Bpf.co.uk*, 2010. <https://www.bpf.co.uk/plastipedia/polymers/pvc.aspx#Physical%20Properties>

“Standard Telescopic Tubing,” *Testrite Aluminum*. <https://www.testritealuminum.com/collections/standard-telescopic-tubing> (accessed Sep. 28, 2023).



Aluminum Rod Design for Presentation

SARAH RAUBENSTINE - Oct 10, 2023, 10:08 AM CDT

Title: Aluminum Rod Design for Presentation

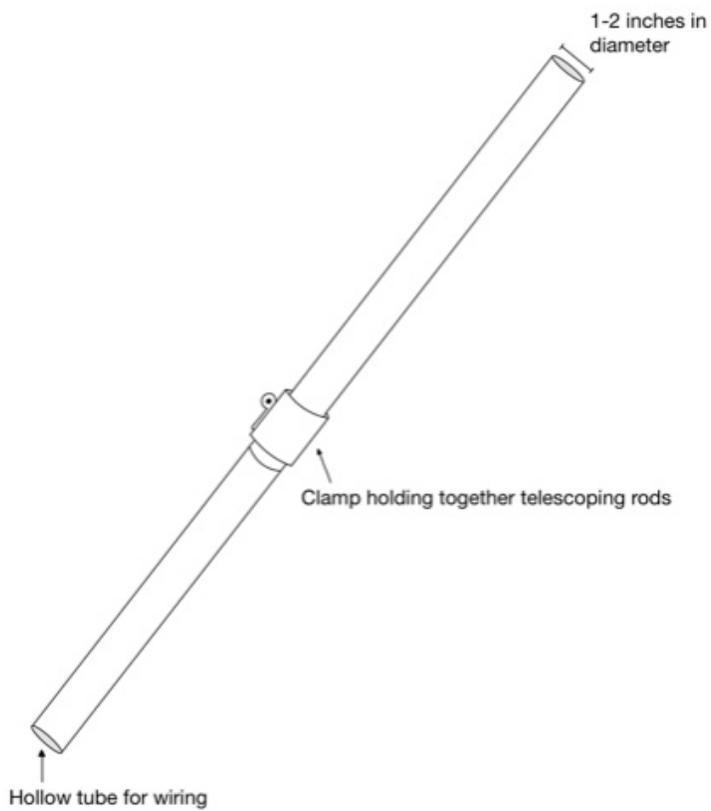
Date: 10/10/23

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: Create depiction of aluminum rod for presentation and preliminary report

Content:



Conclusions/action items: Include in presentation

Carbon Fiber Rod design for Presentation

SARAH RAUBENSTINE - Oct 10, 2023, 10:07 AM CDT

Title: Carbon Fiber Rod Design for Presentation

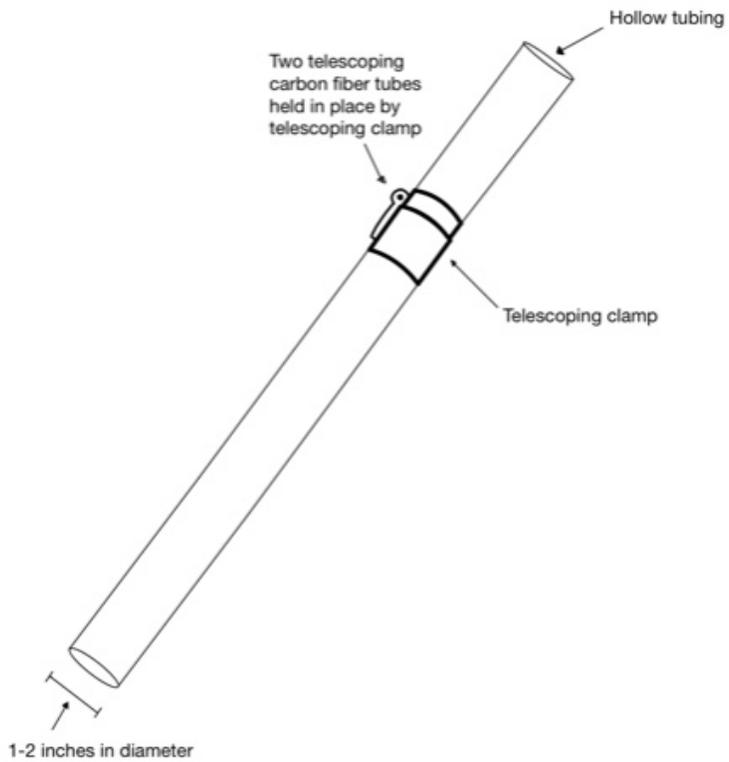
Date: 10/10/23

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: Create depiction of carbon fiber rod for presentation and preliminary report

Content:



Conclusions/action items: Include in Presentation



Initial "Disk" Brainstorm

SARAH RAUBENSTINE - Dec 11, 2023, 11:47 PM CST

Title: Initial Brainstorm of Disk Design

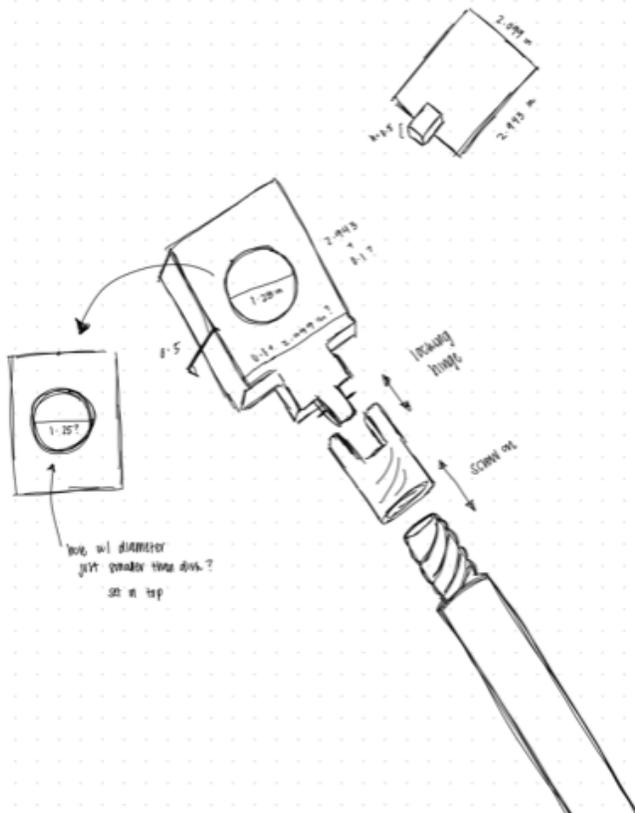
Date: 10/30/23

Content by: Sarah Raubenstine

Present: Sarah Raubenstine

Goals: Create an initial design for the disk at the end of rod

Content: All measurements in inches.



Conclusions/action items: Will propose and edit design with group at next meeting, also included precise measurements of Arduino microcontroller to share with group members when creating first design.



Disk Group Work Notes

Title: Disk group work notes

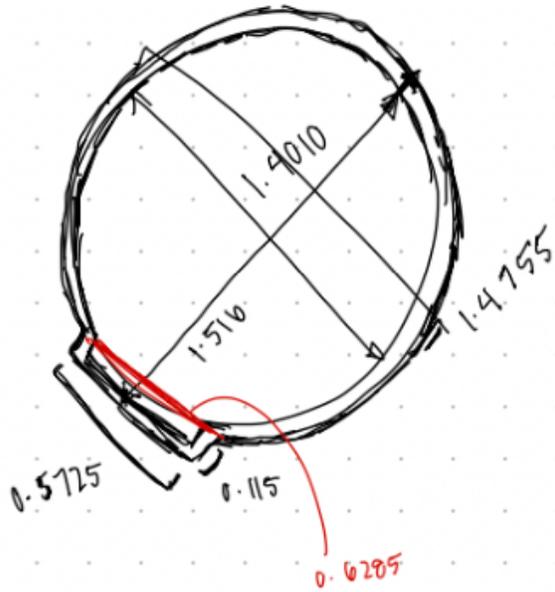
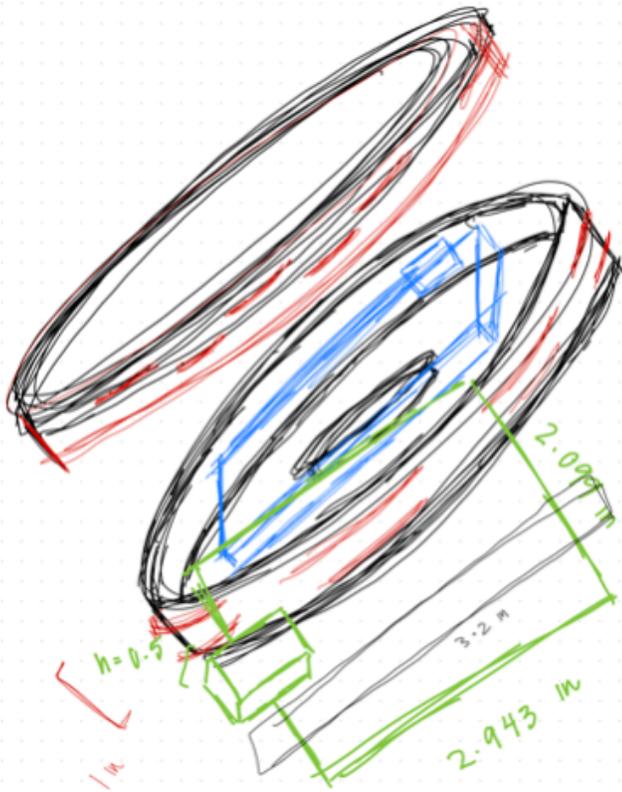
Date: 11/1/23

Content by: Sarah Raubenstein

Present: Sarah Raubenstein, Gianna, Shriya

Goals: Design a disk for the end of the rod that will hold the electronics and LED screen.

Content: All measurements in inches.





Disk redesign notes

SARAH RAUBENSTINE - Dec 11, 2023, 11:46 PM CST

Title: Disk Redesign Notes

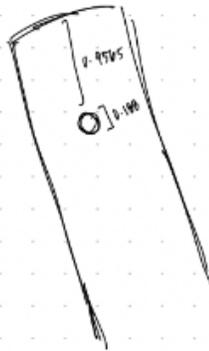
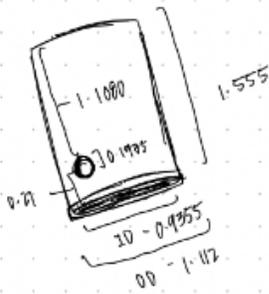
Date: 11/10/23

Content by: Sarah Raubenstine

Present: Sarah Raubenstine, Gianna Inga

Goals: Redesign the solid works file of the disk so it can be fitted onto the rod. Collect measurements of the rod and connecting piece to input into solid works.

Content: All measurements in inches.



Conclusions/action items: Used measurements to create a final solid works design and sent it to the 3D printers in the UW Makerspace.



2023/09/13 Biodex Balance System

Simon Nam - Sep 19, 2023, 7:57 PM CDT

Title: Biodex Balance System

Date: 09/13/2023

Content by: Simon Nam

Present: N/A

Goals: To gain more knowledge about the current, existing devices used for dynamic balance training

<https://www.iprsmediquipe.com/products/biodex-balance-system-sd/#features>

"Biodex Balance System SD." *IPRS Mediquipe*, www.iprsmediquipe.com/products/biodex-balance-system-sd/#features. Accessed 13 Sept. 2023.

Content:

- "SD" stands for "Stability and Balance System."
- The system aims to provide an overview of a patient's balance and stability capabilities. It helps healthcare professionals to recognize the weakness or dysfunction of one patient's balance system.
- It offers real-time visual and auditory feedback to patients during balance assessments and training exercises.
- Healthcare professionals can customize balance training protocols based on the patient's specific needs and abilities which is useful for personalized treatments.
- The system is able to track patient's progress over time
- It can help identify individuals at risk of falling, which makes it valuable for the elders and those recovering from neurological conditions.
- The users of this device can see their center of pressure (COP) on a computer screen in real-time.
-

Conclusions/action items:

The Biodex system is a sophisticated platform with dynamic stability and balance assessment capabilities. It provides visual feedback and controlled perturbations for targeted training. The technology continues to evolve and improve and further usages can be employed based on more research and developments. This idea can be implemented for the BME design projects with its capabilities and specifications on its device tools.



Title: Taking Balance training for older adults on step further

Date: 9/14/23

Content by: Simon Nam

Present: N/A

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4419050/>

A. Halvarsson, I.-M. Dohrn, and A. Ståhle, "Taking balance training for older adults one step further: the rationale for and a description of a proven balance training programme," *Clinical Rehabilitation*, vol. 29, no. 5, pp. 417–425, Sep. 2014, doi: <https://doi.org/10.1177/0269215514546770>.

Goals: To gain more in-depth knowledge about the process of balance training as a practical procedure. To analyze the rehabilitation program of effectiveness in improving balance for elders.

Content:

- two randomized controlled studies including community-dwelling older adults with or without diagnosed osteoporosis
- exercises focused on standing and walking could be prioritized over sitting ones to make the training more specific to balance performance during walking and standing
- In order to optimize the training's effectiveness, it is important to customize the balance training for each individual and to make personalized adjustments
- If the training program is modified, it should remain grounded in the theoretical background of balance control, basic exercise principles, and increasing difficulty

Conclusions/action items: To have a capable successful balance training with a capable device, it must satisfy the client's needs as well as suit the given procedure for reaching test goals and further functionalities for the patients' demonstration test on the device itself.



2023/09/20 Functional Reach Test (FRT)

Simon Nam - Sep 22, 2023, 4:23 AM CDT

Title: Functional Reach Test (FRT)

Date: 09/20/2023

Content by: Simon Nam

Present: N/A

Goals: To gain more knowledge about the Functional Reach Test and its use today in elder rehabilitation

[https://www.physio-pedia.com/Functional_Reach_Test_\(FRT\)](https://www.physio-pedia.com/Functional_Reach_Test_(FRT))

"Functional Reach Test (FRT)," *Physiopedia*. [https://www.physio-pedia.com/Functional_Reach_Test_\(FRT\)](https://www.physio-pedia.com/Functional_Reach_Test_(FRT))

Content:

- a method of dynamic balance training in one simple task
- measurement of distance between the length of an outstretched arm in a maximal forward reach, while maintaining a fixed standing (base)
- Standards of measurements (Categories);
 - 10"/25 cm or greater Low risk of falls;
 - 6"/15cm to 10"/25cm Risk of falling is 2x greater than normal;
 - 6"/15cm or less Risk of falling is 4x greater than normal;
 - Unwilling to reach Risk of falling is 8x greater than normal
- Scores are determined by assessing the difference between the start and end of the reach distance in inches.
- One of the 4 tests used in the [The Balance Outcome Measure for Elder Rehabilitation \(BOOMER\)](#)
- While performing the test for the patient, the therapist should stand in the front that is the direction you reach forward in case of falling

Conclusions/action items:

The Functional Reach Test is a simple and widely used clinical assessment tool in the rehabilitation, for accessing the balance and functional mobility of elders. It is designed to measure one's ability to reach forward without taking a step and provides valuable information about their risk of falling. It helps healthcare professionals tailor their rehabilitation programs to improve these crucial aspects of function and reduce the risk of falls for the patients.



2023/09/26 Dynamic Balance training

Simon Nam - Sep 29, 2023, 10:49 AM CDT

Title: Relationship Between Dynamic Balance Measures and Functional Performance in Community-Dwelling Elderly People

Date: 09/26/2023

Content by: Simon Nam

Present: N/A

Goals: To evaluate and research a new mode of dynamic balance assesment test for identifying individuals at risk for falling in a group of community-dwelling older adults.

Content:

<https://academic.oup.com/ptj/article/90/5/748/2737823#190807348>

Poor balance control (leading to fear of falling), mobility restrictions, and fall injuries are common in older adults and people with neurological disorders. Test protocols and data analysis methods for daily clinical use have been developed to quantify a patient's capacity to adapt balance and gaze stability to a few altered sensory conditions and tasks (eg, Timed "Up & Go" Test, Berg Balance Scale, modified Clinical Test of Sensory Interaction and Balance).

Conclusions/action items:



1st Meeting with the client (9/12)

Simon Nam - Sep 15, 2023, 12:44 PM CDT

Title: 1st Meeting with the client

Date: 9/12/2023

Content by: Simon Nam

Present: N/A

Goals: Establish a clear knowledge and expectation from the client about the products' requirements and needs

Content:

- **Reaching out to specific target**, having a colored dot pointing for the target reach
 - Brain injury, neglect, scan & find the target (dots)
 - Needs to be a one hand control;
 - Must have color variation / Numbers —> Symbol/Shapes
 - Consideration for colorblind patients
 - Functional Reach Test* capability (distance measurer)
 - Left-hand attention
 - The size can be 3 inches in diameter, 2-3 feet for distance in shape of disc
 - Must have long life duration
 - Should stay hygiene, water proof
 - The material should be light weight but strong enough not break
 - The device can be hookable with lanyard
 - The estimated budget can be around \$300

Conclusions/action items: Search for more real life practical applications similar to the description told above by the client. Analyze further into physical demonstration of trainings shown the videos sent by the client furthermore.



2023/09/20 Optical Golf Rangefinder

Simon Nam - Sep 22, 2023, 4:40 AM CDT

Title: How do optical golf rangefinder work?

Date: 09/20/2023

Content by: Simon Nam

Present: N/A

Goals: To gain more knowledge about how optical golf rangefinder are used today and its mechanism

<https://southamptongolfclub.com/how-do-optical-golf-rangefinders-work/>

KunLehane, "How Do Optical Golf Rangefinders Work? A Complete Guide," *The Expert Golf Website*, Jul. 24, 2020.
<https://southamptongolfclub.com/how-do-optical-golf-rangefinders-work/> (accessed Sep. 22, 2023).

Content:

- Originally optical rangefinders were used to determine the range of target for artillery.
- It uses triangulation for measuring accurate distance where the back lens points straight and the front lens points to the left or right by 90 degree. When both lenses focus on the same target, the pin uses basic trigonometry to read the distance to the target.
- It has two lenses, one points straight ahead and one points 90 degrees to the right.
- Advantages;
 - Cheap
 - Relatively Accurate
 - No batteries needed
- Disadvantages
 - Need a steady hand for operating to focus the triangle in the rangefinder exactly on the target
 - Only works when you can see the target
 - Accuracy in which they still may only give 90% accuracy and 95% accuracy within 100 yards

Conclusions/action items:

An optical rangefinder is composed of two lenses, one points straight ahead and one points 90 degrees to the right. By focusing the lenses together and a triangle forms and we are able to get the distance where this triangle is focusing by using triangulation. Need to figure out if the actual setup process of optical rangefinder device is possible.



2023/09/25 Ribbed Gym Handle

Simon Nam - Sep 29, 2023, 10:38 AM CDT

Title: Ribbed Gym Handle

Date: 2023/09/25

Content by: Simon Nam

Present: N/A

Goals: To gather ideas for design matrix that focuses on the handle component of the device

Content:

<https://www.mcmaster.com/products/grips/round-grips-6/?s=vinyl+plastic+round+grips>

“McMaster-Carr,” [www.mcmaster.com](https://www.mcmaster.com/97045K68/). <https://www.mcmaster.com/97045K68/> (accessed Sep. 24, 2023).

The ribbed gym handle design is inspired by the common, daily use of ribbed handles of the gym equipment for people to grab and apply force for their physical training. It is an ideal design choice for the handle with lack of slipping, capability of gripping, and further minor adjustment for the ergonomic design. This design choice can be achieved that can suit well with the other components of the device.

Conclusions/action items: N/A



2023/09/29 Button Bluetooth ring remote kit

Simon Nam - Sep 29, 2023, 2:06 PM CDT

Title: Button Bluetooth Remote Control Kit, Smart Finger Remote Control Page Turner Phone Controller Compatible with iOS and Android

Date: 09/29/23

Content by: Simon Nam

Present: N/A

Goals: To utilize this product into our project's design idea

Content:

<https://www.amazon.com/Bluetooth-Control-Controller-Compatible-Android/dp/B0C1XNBDSB>

Power source type: Battery powered

Connectivity Technology: Bluetooth

- Easy Page Turner: Cell phone camera shutter remote can easily turn the page remotely, one key remote control, enjoy the comfort.
- Ergonomic Design: Smart finger remote is suitable for different width fingers, charging port facing outward, indicator light to the right.
- High Performance: Bluetooth button clicker is compact, large capacity, low power consumption, long battery life, charging 2H, continuous working 48H.
- Support APP: Phone Bluetooth ring remote control supports many kinds of mainstream short video APP, beauty camera, novel APP
- Bluetooth 5.3: Bluetooth remote control page turner adopts Bluetooth 5.3, which is easy to use, easy to match and stable operation.

Conclusions/action items:



2023/10/31 Battery Life & Options

Title: Battery Life & Options**Date:** 10/31/2023**Content by:** Simon**Present:** N/A**Goals:** To research and gather more ideas about battery options for the prototype design**Content:**

- 3 AAA pack (1.5 V each) in disk
- Coin Lithium Battery 2 pack (3V each) in disk
 - Stack 2 of them to produce combined --> 12 V
- Arduino CC/UNO R-3 Voltages Input 7-12 V / Operating 5V

The Arduino Uno R3 operates at 5V. If you are using regular LED lights with a forward voltage of around 2V and a current of 20mA. Can power them directly from the Arduino's digital pins without any additional resistors.

Let's consider the two battery options you mentioned:

-
- **3 AAA Battery Pack (1.5V each):**
 - Voltage: 3 AAA batteries provide a total voltage of 4.5V (1.5V * 3).
 - Capacity: AAA batteries typically have a capacity of around 1000-1200 milliampere-hours (mAh) each. So, the total capacity of three AAA batteries would be approximately 3000-3600mAh.
- **2 Coin Lithium Battery Pack (3V each):**
 - Voltage: 2 coin lithium batteries provide a total voltage of 6V (3V * 2).
 - Capacity: Coin lithium batteries usually have lower capacity compared to AAA batteries. Assume each coin battery has a capacity of around 200-300mAh. So, the total capacity of two coin lithium batteries would be approximately 400-600mAh.

Considering the voltage requirements of the Arduino Uno R3 and the LEDs, both options can technically power the setup. However, for longer battery life, the AAA battery pack would likely be the better choice due to its higher total capacity (3000-3600mAh). This higher capacity means the batteries can provide a steady current for a longer time, resulting in extended operation of your lights compared to the coin lithium batteries with their lower total capacity (400-600mAh).

- Or Disk battery on handle (toggle switch?)

<https://www.instructables.com/Powering-Arduino-with-a-Battery/>

Conclusions/action items:



2023/11/10 - Tong Distinguished Lecture notes

Simon Nam - Nov 10, 2023, 12:25 PM CST

Simon Nam - Nov 10, 2023, 12:48 PM CST

Title: Tong Distinguished Lecture

Date: 11/10/2023

Content by: Simon

Present: Travelle (Franklin-Ford) Ellis, MD, PhD

Goals: To learn more about the impact as an engineer

Content: One Engineer's Journey: Where Preparation Meets Opportunity

-Speaker based from a different, unique background

-Your Story, not inspired to be an engineer, but grasping beyond that scope

-Find your people around you that will shape your life

-Do the things that are scary, not too much

-Laugh until you cry, cry until you laugh

-Leading into passion, having a purpose, engaging with like-minded others

-Have a story with setting that envisions the future and carry you on the journey

*Everyone is counting on you

P.S. - YOU will do this too!

Q&A:

"How to get over something that you worked hard on but does not seem to resolve (failures, troubles, etc)?"

Speaker: "Being organized, as a degree professional, knowing the strengths and weakness, figuring out what can I do and looking through different options. Took a step back, talked to people. Led to a point to realize to treat people and entering different system besides medicine. Looking at the drafts and possible options and highlighting which ones are the most suitable"

"Future prospects of position in current workplace?"

Speaker: "Extrapolating projects from Precision Medicine; building a better impact"

"What does it look like to keep in touch with people in your lives?"

Speaker: "Missing dedicated 1:1; have to be more intentional and reach out more to people with trying harder. Even to those who you have not talked in years, invest in them"

"Internship, what other positions did you have?"

Speaker: "MSL (Medical Science Liaison--> talk about science and clinical evidence in a casual form to another"

"Equitable access to healthcare"

Speaker: "Uninsured percentage in the society, engaging more people who do not have full access. Business that includes more individuals to segment the aspects of serving and customizing for each individuals needs"



BPAG Meeting 9/29

Simon Nam - Oct 11, 2023, 2:07 PM CDT

Title: BPAG Meeting

Date: 9/29/23

Content by: Simon Nam

Present: John Puccinelli

Goals: For general information about the roles of BPAG

Content:

- Going over the steps of UW Client vs. Non UW client payment procedure
- Making spreadsheet and saving all the official receipts for the case when the BPAG is paying and getting reimbursed afterwards
- Making sure the client all the information to prior to the information
- Costs of each team member for semester
- Available UW affiliated Vendors

Conclusions/action items: Confirm with the client about the payment procedure, make sure to agree upon how the purchase materials are processed before the final payment



2014/11/03-Entry guidelines

John Puccinelli - Sep 05, 2016, 1:18 PM CDT

Use this as a guide for every entry

- Every text entry of your notebook should have the **bold titles** below.
- Every page/entry should be **named starting with the date** of the entry's first creation/activity. subsequent material from future dates can be added later.

You can create a copy of the blank template by first opening the desired folder, clicking on "New", selecting "Copy Existing Page...", and then select "2014/11/03-Template")

Title: Descriptive title (i.e. Client Meeting)

Date: 9/5/2016

Content by: The one person who wrote the content

Present: Names of those present if more than just you (not necessary for individual work)

Goals: Establish clear goals for all text entries (meetings, individual work, etc.).

Content:

Contains clear and organized notes (also includes any references used)

Conclusions/action items:

Recap only the most significant findings and/or action items resulting from the entry.



Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: