Knee Crutch

Date: 11/6/25
Client: Daniel Kutschera
Advisor: Randy Bartels

Team:
Violet Urdahl - Team Leader (vurdahl@wisc.edu)
Tess Fitzgerald - Communicator (tkfitzgerald@wisc.edu)
Aubrey Younker - BPAG (ayounker@wisc.edu)
Lauren Anderson - BSAC (ldanderson6@wisc.edu)
Kayla Christy - BSAC (kjchristy@wisc.edu)
Evan Koelemay - BWIG (ekoelemay@wisc.edu)

Problem Statement:

Knee crutches are an assistive device used to help non-weight-bearing patients recovering from a lower limb injury move efficiently and comfortably. Current devices available target assistance with walking, but are not suitable for ascending or descending stairs. To ensure patients can get home safely, the improved knee crutch will provide ample stability and assistance for stair climbing without the additional use of crutches. The goal is to create an improved version of an existing prototype that will provide users with sufficient mobility and stability when climbing stairs.

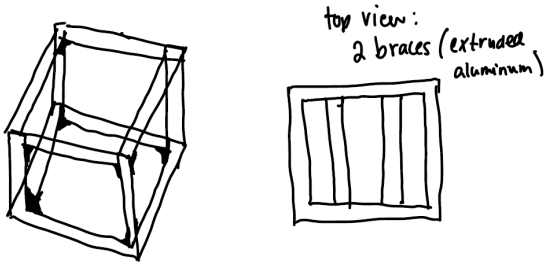
Brief Status Update:

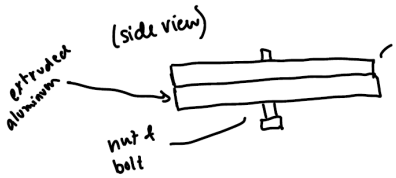
The team was able to meet and discuss the advice and recommendations we received from our peers during show and tell. One of the main action items we asked for guidance on was how to attach our knee rest component and the knee rest cushion. Many peers recommended using strong velcro strips to attach the foam cushion component to our adjustable blocks, so the team discussed and decided to move forward with this design change. Additionally, we made a design modification to the bottom of the base. We've decided to add aluminum rods between the base legs, connecting them in order to avoid having the device completely slip off the stairs if one leg comes close to the edge. Lastly, team members were able to 3D print the platform blocks for our adjustability component. Further fabrication will be based on the measurements and placements of the holes in those blocks.

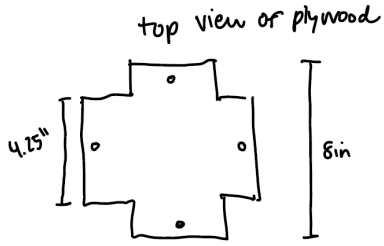
Project Difficulties/Advice Requests:

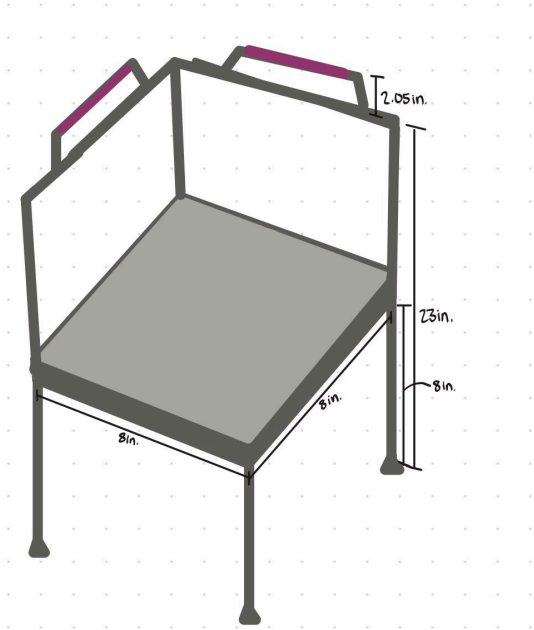
- None to report

Current Design:









Materials and Expenses:

- See table below:

Item	Description	Manufac-turer	Date	#	Cost Each	Total	Link
HDP	3D printing material for knee support	Makerspace	Purchased on 11/5/25	Pair of blocks	$18.33	$18.33	N/A
Extruded Aluminum Set with Connectors	Material for legs and knee support frame	Home Depot	Purchased on 10/10	1 set of 4 rods and connector sets	$43.70	$43.70	link
Memory foam cushion	Material for knee to rest directly on	TBD	Have not purchased	N/A	N/A	$0.00	
Rubber base	Material for non-slip bottom base	Amazon	Have not purchased	N/A	N/A	$0.00	
Additional Connectors for Extruded Aluminum rods	Set of 10 extruded aluminum rod connectors	Amazon	Purchased on 10/10 and 10/24	3 set of 10 connectors	$12.99	$37.97	link
Aluminum T-slot Handles	Set of 4, 7.5in aluminum handles compatible with t-slotted aluminum	Amazon	Purchased on 10/24	1 set of 4 handles	$27.59	$27.59	link
Grip Tape	Pack of 10 small rolls of multicolor grip tape	Amazon	Purchased on 10/24	1 pack of 10 rolls	$9.99	$9.99	link
					TOTAL:	**$141.69 with Tax**	

Team Goals for Upcoming Week:

- Meet with our client to talk about a potential hospital visit and patient testing
- Continue fabrication of the knee rest component
- Consider specific methods of stabilization and force plate testing

Individual Goals for Upcoming Week:

- Tess Fitzgerald
    - Attend design consultation and fabricate the plywood to base
    - Pick up 3D printed blocks from makerspace and attach to base
    - Meet with client to discuss hospital visit
- Aubrianna Younker
    - See if the makerspace or design lab has bolts and t-slot screw components that work with our design, rather than ordering online
    - Submit IRB for patient device testing
    - Create the Google survey we will use during our human subjects test
    - Attach handle components to the base and knee rest components
- Lauren Anderson
    - Attend the design consultation meeting to be able to continue to fabricate our project
    - Order materials to fabricate the cushion of the knee crutch
    - Finalize testing plans, create survey and solidify plans for stability testing
- Violet Urdahl
    - Attend design consultation meeting
    - Finalize base fabrication
    - Create testing plan
- Kayla Christy
    - Attend BSAC meeting
    - Attend required lecture
    - Update our prototype sketch
    - Continue research and updating labarchives
- Evan Koelemay
    - Attend group lecture
    - Modify base design
    - Research

Timeline

Task	September				October				November					December	
	5	12	19	26	3	10	17	24	31	7	14	21	28	5	10
Deliverables															

Progress Reports		**X**	X	X	X	X	X	X	X						
PDS Draft			X												
Design Matrix				X											
Preliminary Presentations					X										
Preliminary Lab Notebook						X									
Preliminary Report						X									
Preliminary Evaluations						X									
Show and Tell									X						
Final Poster Presentation															
Final Lab Notebook															
Final Report															
Final Evaluations															
Meetings															
Team	**X**	X	X	X	X	X	X	X	X						
Client	X			X		X									
Advisor			X		X		X	X							
Website															
Update	**X**	X	X	X	X	X	X	X	X						

Previous week's goals and accomplishments:

- Tess Fitzgerald
    - Went makerspace to get height adjustment blocks printed
    - Attended show and tell and revised base after receiving feedback
    - Met with team to discuss design consultation date
- Aubrianna Younker
    - Ordered additional extruded aluminum connector components to accommodate our design addition
    - Filled in group portions of the weekly progress report
    - Continued research on IRB requirements and expedited review criteria
- Lauren Anderson
    - Attended show and tell and addressed the feedback with my team
    - Discussed fabrication changes and scheduled a design consultation for November 11th
    - Continued researching methods of testing
- Violet Urdahl
    - Conducted research on standards and regulations
    - Revised base design based on feedback from peers at show and tell

- Evan Koelemay
    - Attended show and tell
    - Discussed changes to the base of the design based on recommendations from peers
    - Research
- Kayla Christy
    - Attended show and tell
    - Team meeting to address feedback and plans for our prototype
    - Continued research

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Violet Urdahl	11/1/25	Research and design revisions	2	2	20.5
Aubrianna Younker	11/5/25	Material ordering and expense sheet updating, IRB research, and group weekly update	1.5hrs	1.5hrs	21.5hrs
Tess Fitzgerald	11/5/25	Made 3D print order at makerspace, revised knee rest design dimensions.	1.5	1.5	19.5h
Lauren Anderson		Scheduled consultation, group meeting, show and tell	1.5	1.5	19.5h
Evan Koelemay	11/6/25	Group meeting, show and tell, research	1.5	1.5	18.5hrs
Kayla Christy	11/5/25	Research			21h
Whole Team	11/3/25	Team fabrication meeting and show and tell	3	3	18.5h
Whole Team + Advisor Meeting	N/A	N/A	N/A	N/A	