Knee Crutch

Date: 11/20/25
Client: Daniel Kutschera
Advisor: Randy Bartels

Team:
Violet Urdahl - Team Leader (vurdahl@wisc.edu)
Tess Fitzgerald - Communicator (tkfitzgerald@wisc.edu)
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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.

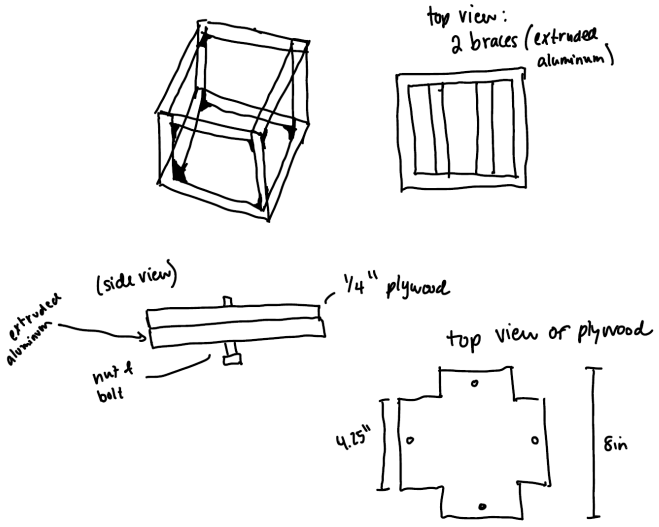
Brief Status Update:

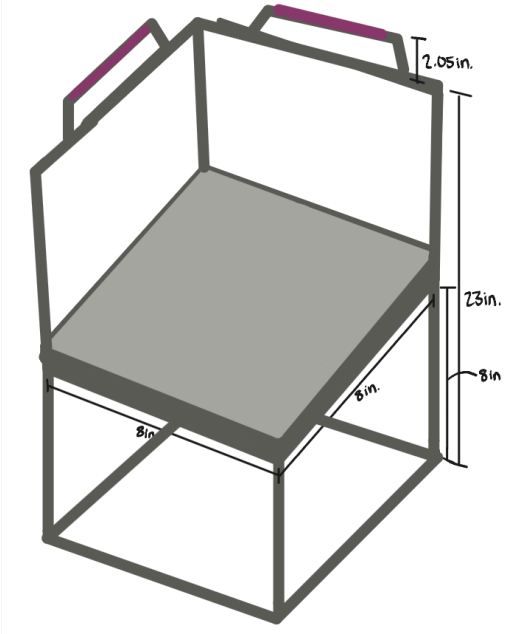
This week, the team was able to implement the design changes that were made last week. After disassembling the original base, we were able to use the mill to cut three long pieces of aluminum down to even length, allowing them to extend from the floor up to the handle. Once cut down, we were able to reuse some parts from the original base to reassemble it, creating our current prototype, pictured below. With those changes, almost all the fabrication is complete, excluding the tread, one handle, and the cushion component. Once the foam and velcro arrived, we made plans to complete fabrication and ordered a few last-minute components to do so. Tentatively, the prototype will be finished and ready for testing this coming Monday.

Project Difficulties/Advice Requests:

- none

Current Design:


top view:
2 braces (extruded aluminum)
(side view)
1/4" plywood
extruded aluminum
nut & bolt
top view of plywood
4.25"
8in


2.05in.
23in.
8in
8in.
8in

Materials and Expenses:

- See table below:

Item	Description	Manufac-turer	Date	#	Cost Each	Total	Link
PLA	3D printing material for knee support	Makerspace	Purchased on 11/5/25	Pair of blocks	$18.33	$24.70	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	Amazon	Purchased on 11/11	1 piece of custom size foam	$19.36	$19.36	link
Rubber base grip tape	Grip tape for non-slip base	Amazon	Purchased on 11/18	1, 10 foot roll	$19.95	$19.95	link
Additional Connectors for Extruded Aluminum	Set of 10 extruded aluminum rod	Amazon	Purchased on 10/10 and 10/24	3 set of 10 connectors	$12.99	$37.97	link

rods	connectors						
Aluminum T-slot Handles	Set of 4, 7.5in and 4.7in aluminum handles compatible with t-slotted aluminum	Amazon	Purchased on 10/24	2 sets of 4 handles	$27.59 and $20.42	$48.01	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
Velcro strips	8 pack of black 1x2 inch strips	Amazon	Purchased on 11/11 and 11/17	2 pack of 8 pieces	$13.70	$27.40	
Long bolts	8 sets of long bolts, lock washers, and washers	amazon	Purchased on 11/7	1 pack of 8 sets of long bolts	$9.99	$9.99	link
					TOTAL:	**$240.77 with Tax**	

Team Goals for Upcoming Week:

- Finalize all parts of the Prototype
- Complete dynamic stability testing
- Create group documents for all final deliverables in the shared drive

Individual Goals for Upcoming Week:

- Tess Fitzgerald
    - Begin user testing
    - Confirm hospital visit date with client
    - Perform stability testing
- Aubrianna Younker
    - Start creating an outline for final deliverables
    - Finalize testing protocols
    - Prepare BPAG receipts and spreadsheet for the client and report

- Lauren Anderson
    - Finish fabrication of the cushion and construct the final connector pieces
    - Finish the online survey for students to take about the project
    - Survey people on the knee crutch this weekend
    - Begin statistical analysis on the survey data
- Violet Urdahl
    - Finish fabrication
    - Complete testing
    - Begin work on final deliverables
- Kayla Christy
    - Finish Fabrication
    - Begin working on final deliverables
    - Update LabArchives
    - Attend BSAC meeting
- Evan Koelemay
    - Finish fabrication
    - Test prototype with students
    - Begin final deliverables

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	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	X	X				
Client	X			X		X				X					

Advisor			X		X		X	X		X	X				
Website															
Update	**X**	X	X	X	X	X	X	X	X	X	X				

Previous week's goals and accomplishments:

- Tess Fitzgerald
    - Ordered foam for knee rest
    - Cut foam to fit on knee rest
    - Finished fabrication of base, handle, and knee rest component
- Aubrianna Younker
    - Ordered new handles, more velcro, and grip tape for the tread
    - Researched the rehabilitation of amputee patients
    - Reconstructed the base and cut aluminum rods down to size
    - Wrote group portions of the progress report
- Lauren Anderson
    - Attended design consultation and updated fabrication with the feedback
    - Completed the frame of the knee crutch
    - Updated lab archives with information from the updated fabrication plan
- Violet Urdahl
    - Created SolidWorks design of our prototype
    - Completed fabrication of base
    - Cut foam for knee pad
- Evan Koelemay
    - Used the mill to update the base to contain the handles
    - Added grip tape to base to prevent slippage and add stability
    - Cut foam to the correct size for the knee pad
- Kayla Christy
    - Attend BSAC meeting
    - Fabrication of the prototype
    - Used the mill to cut components to exact length
    - Updated LabArchives
    - Attended Design Consultation

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)

Violet Urdahl	11/19	Completed SolidWorks file and fabrication	5	27.5	27.5
Aubrianna Younker	11/19	Fabrication, research, group progress report, and material ordering	5hrs	5hrs	29hrs
Tess Fitzgerald	11/19/25	Fabrication, client communication	4hr	4hr	27h
Lauren Anderson	11/19/25	Fabrication, documentation, and design consultation			22h
Evan Koelemay	11/19/25	Fabrication, machining	5 hrs	5hrs	25.5hrs
Kayla Christy	11/19/25	Fabrication, Design consultation, research.	6 hrs	6 hrs	27h
Whole Team	11/17/25	Testing and final fabrication planning	1 hr		22hrs
Whole Team + Advisor Meeting	-	No advisor meeting this week	-	-	