GCU and ACCEL Partnership: Mobility Chair Group 1

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GCU and ACCEL Partnership

A GCU Capstone team and ACCEL partnered together to create a mobility chair for a student at the ACCEL school in Phoenix. The chair is personalized to the student's disabilities and will assist the student to function with everyday activities.

Project Purpose

- Create a personalized chair to help with the student's disabilities
- For the student to keep the chair to use at school and at home
- To provide safe and comfortable transportation

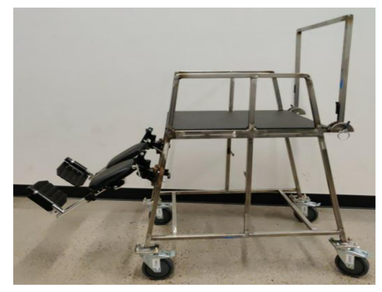
Functional Requirement	Required Measurement	Related Standard
Reclining back angle (custom requirement from OT)	Less than 135 Degree Recline	ISO 7176-30:2018 Stability of chair at reclining angle
Plays music and provides vibrations throughout chair seat to the frequency of the music	Will hear sound and feel vibration	No universal standard exists according to WHO in regards to personal audio systems. Closest standard is EN 50332-1:2013 for safe listening in workplace environments, which will be metric tested against.
Wheels lock and have effective multidirectional brakes	The wheelchair must lock on a standard wheelchair ramp and on multiple floor surface types	16-170 ISO 7176-11 Determination of effectiveness of brakes.
Head and neck is supported by chair	The chair must provide head and neck support to support a person's full body weight leaning to one side or the other	No relevant standards exist for wheelchair headrests. Closest standard is 72 RF 25484 for headrest safety standards in motor vehicles, which will be metric tested against.
Fabric is biocompatible and will not cause tissue damage	Fabric will maintain tissue integrity	ISO 16840-2:2018 Determination of physical and mechanical characteristics to manage tissue integrity
Lateral support will be on the chair for the student	Must stop the student from falling side to side	No relevant standards - Custom requirement set by occupational therapist.

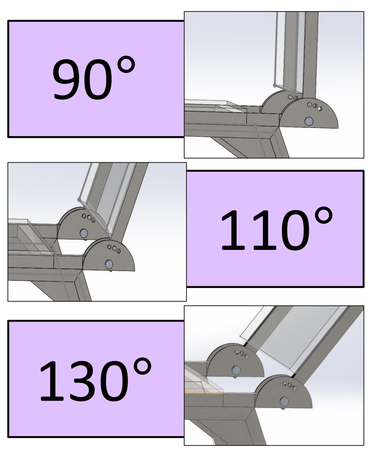
References:

American National Standards Institute. (2018). *Wheelchair Seating - Part 2: Determination of physical and mechanical characteristics of seat cushions intended to manage tissue integrity.* (Standard No. 16840-2). Retrieved from https://www.iso.org/standard/66972.html
American National Standards Institute. (2018). *Wheelchairs - Part 30: Wheelchairs for changing occupant posture - Test methods and requirements.* (Standard No. 7176-30). Retrieved from https://www.iso.org/standard/66524.html
American National Standards Institute. (1992). *Wheelchairs - Volume 2: Additional requirements for wheelchairs (including scooters) with electrical systems Section 4: Determination of effectiveness of brakes.* (Standard No. 16-170 ISO 7176-11). Retrieved from https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm?ID=ITI
European Committee for Standards. (2013). *Sound System Equipment: Headphones and earphones associated with personal music players - Maximum sound pressure level measurement methodology - Part 1: General method for "one package equipment.* (Standard No. 50332-1). Retrieved from https://infostore.saiglobal.com/en-us/Standards/EN-50332-1-2013-349137_SAIG_CENELEC_CENELEC_797587/.

Design Process

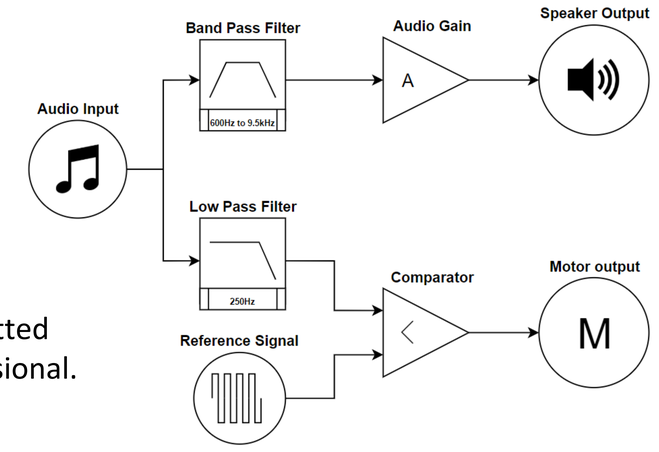
- The frame of the chair is made from hollow ¾ inch stainless steel. This provides strength and rust-resistance at a light weight.
- Retractable and reclining leg rests provide support at multiple angles.
- ABS plastic is a durable, strong, aesthetically pleasing and light weight seating solution.
- The reclining back angle fulfills all the functional requirements of the design, reclining to 90 °, 110° and 130°.





- Tactile manipulatives were added to the chair to give the student a sensory distraction while they are sitting in the chair.
- A basket was added underneath the chair to hold the belongings of the student and their assistant or family members.

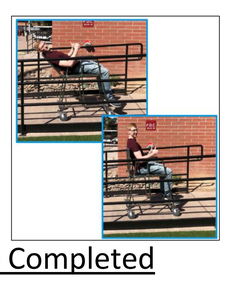
- The audio circuit filters the high frequencies to the speakers, and the low frequencies to the ERM motors.
- This allows the student to both listen to and 'feel' the music that is inputted into the system by the paraprofessional.

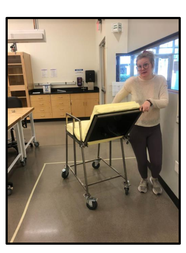


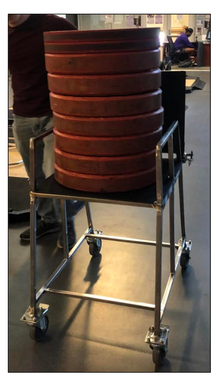
Final Product and Verification Testing

Completed

The chair successfully bears +450 lbs of weight and can recline to 90 °, 110° and 130°.
All the wheels have multidirectional locks; the design is stable enough to resist tipping on inclining.
The chair fits through standard doorways in accordance with the American Disability Act.







To Be Completed

The headrest and lateral supports will be tested by having an individual sit in the chair and lean against the supports.
The circuit will be tested for its frequency response and evaluated for proper audio levels and vibration strength.