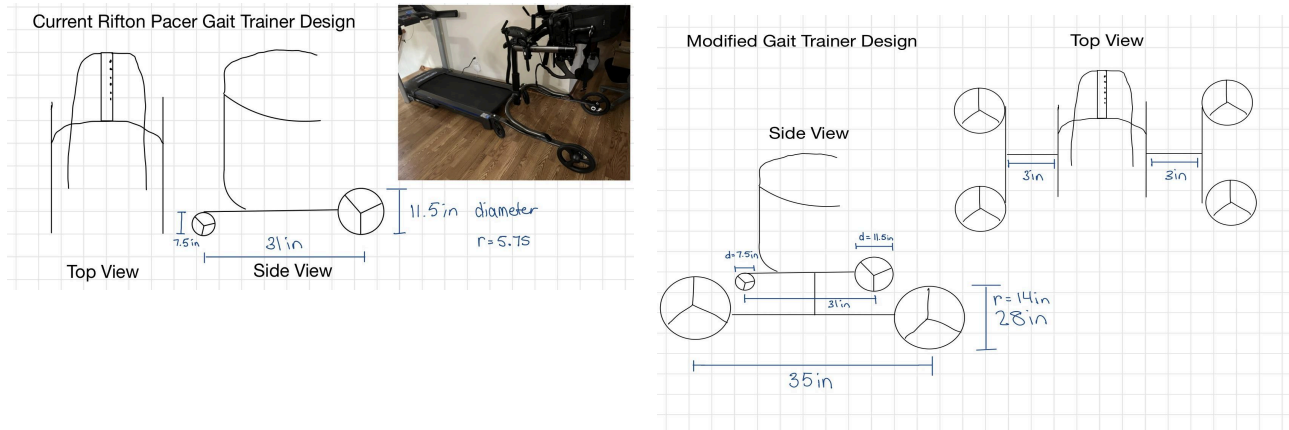


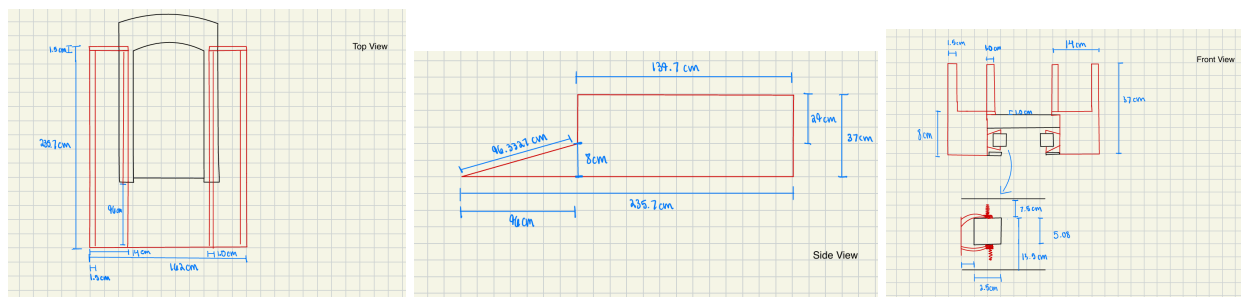
Design Ideas

Altered Gait Trainer



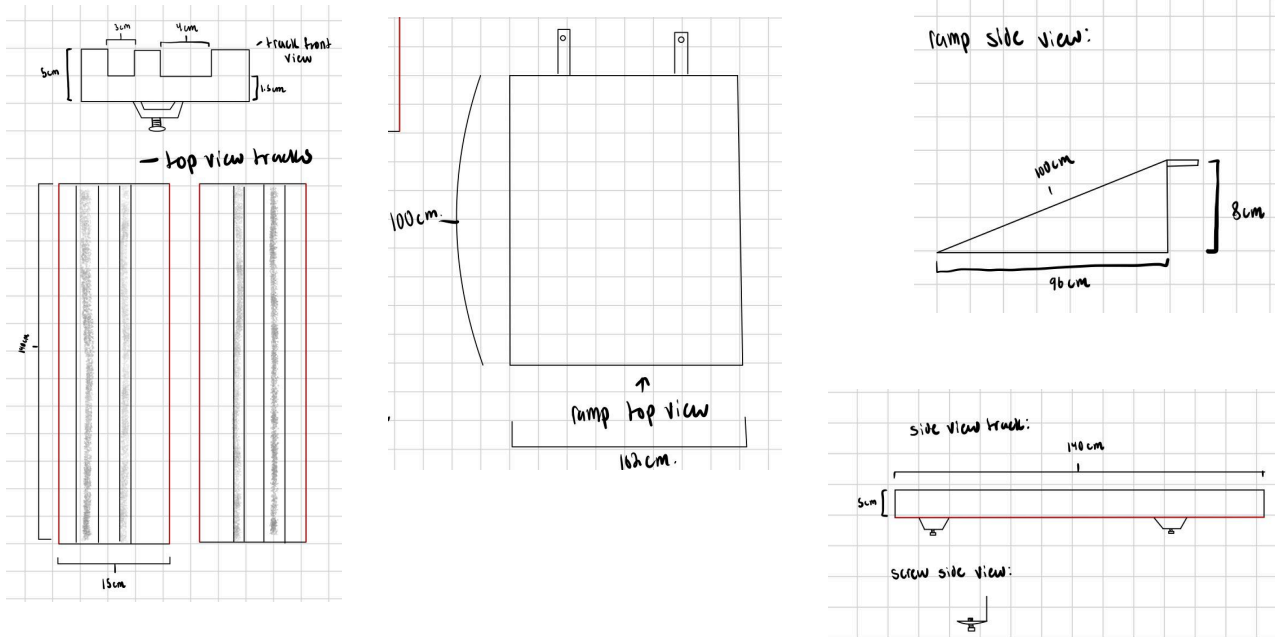
The modified gait trainer design will have an attachable/detachable set of wheels on each side of the gait trainer. These wheels will be larger in diameter raising the height of the entire gait trainer up so the current wheels will hover the treadmill sides. The larger wheels will extend out so they are able to go on the outside of the base of the treadmill.

Ramp and Tracks Connected Design



The ramp and track connected design is a concept with a ramp and a train-track inspired locking system. The ramp and tracks connect to the track by a clamping system. There are elevated surfaces surrounding the wheels of the gait trainer to safely secure the wheels.

Ramp and Tracks Disconnected Design



The ramp and track separated design is a concept in which each track that will be connected to the sides of the treadmill, and the ramp are all disconnected. The tracks will each have an easily attachable and detachable screw in method for stabilizing them to the treadmill. This same screw-in device will be how the ramp is attached to the tracks when it is needed to get onto the treadmill. The tracks have deeper tracks embedded in them for the wheels of the gait trainer.

Design Matrix

Criteria (weight)	Design 1: Ramp and Tracks connected		Design 2: Ramp and Tracks disconnected		Design 3: Altered Gait Trainer	
	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Safety (25)	4/5	20/25	4/5	20/25	2/5	10/25
Ease of Use (30)	3/5	18/30	4/5	24/30	2/5	12/30
Cost (10)	4/5	8/10	4/5	8/10	2/5	4/10
Ease of Fabrication(15)	4/5	12/15	4/5	12/15	2/5	6/15
Durability (20)	4/5	16/20	4/5	18/20	2/5	12/20
	Sum	74/100	Sum	82/100	Sum	44/100

Design Criteria

Safety- The safety of the project is one of the most important factors to consider because of the use of the design. The design will be used for the client with a neurological disorder which

causes mobility issues. The design should restrict gait trainer movement while in use, withstand a large amount of force, and effectively guard the gait trainer and client from injury. Safety is one of the most important aspects of the design, which is why it is ranked on the higher end.

Ease of use - The ease of use of the project is the most important factor to consider due to the nature of the device, and the purpose of it. The design will be used by our client with severe mobility restrictions. She is aided by two people at all times and cannot walk without the assistance of these two people, and her gait trainer. The device must be extremely simple to install on the treadmill, use to get onto the treadmill, and while on the treadmill, and take off the treadmill. The purpose of this project altogether is to allow for the client to easily utilize her treadmill, if the design is not easy to use it defeats the purpose of the project altogether.

Cost - The cost rankings are based on the ability for all design materials to stay within our \$500 budget. The materials used should ensure maximum safety, durability, ease of use and ease of fabrication all while staying within the budget. This helps to prioritize design choices and components to keep it both functional and economical. Staying within budget will allow for flexibility for unforeseen expenses.

Ease of fabrication - The ease of fabrication is based on the ability to fabricate the prototype within the allotted time period of this class. This includes leaving time for testing and making an aesthetic finish. This also includes the ability to alter materials with the technology available to us. This helps us prioritize the designs with practical materials, and designs that we will be able to improve upon through hands-on fabrication.

Durability- The durability of the design refers to its ability to withstand pressure over time, while still maintaining its functionality. All designs are ones which are removable solutions and will be consistently attached to the treadmill, so it is important to ensure that the design can withstand constant amounts of friction and force applied. Durability rankings will be assessed by ranking factors such as material strength, response to environmental stressors, and its predicted longevity.

Design Scoring

Design one: Ramp and Tracks connected

Safety - The first design, ramp and track connected, scored a four out of five for its safety. The design scored a high rating in safety due to its stability and overall strength. The ramp and tracks being connected allows for full connection between pieces, preventing any gaps or spaces. Additionally, the large guards on the tracks secure the gait trainer onto the track while the client is using the treadmill. The ramp attached to the system follows ADA regulations[1],

allowing the most safe option for entering the system. The potential risk of safety is due to the connection system. The connection system may cause a large shift if assembled incorrectly that could potentially harm the client.

Ease of use - The ramp and tracks connected designed scored a three out of five in the ease of use category. While the device itself would be relatively simple to use once installed, due to the ramp and tracks being all one connected device, the installation and deinstallation would be difficult. The device as whole would be much larger than the other designs, as well as much heavier to carry and install. Overall, while it is simple to use all together, the awkwardness of the shape, the design's weight, and its size lead it to receive the score it does.

Cost - This design uses a wooden ramp and track system. A 19/32in x 4ft x 8ft sheet of plywood costs approximately \$40. Lumber such as a 2x4ft costs under \$5 [2]. Clamps such as a tiger clamp run under \$40 for a set of 4 [3]. The total cost of this design would be under \$300 which is significantly under our budget. This is a very affordable design option ranking it high.

Ease of fabrication - The ramp and tracks connected scored a four out of five. This project uses rather inexpensive material that is also fairly easy to alter. It is also a project that we would be able to make smaller prototypes to learn from, before making larger prototypes and the final prototype allowing for rapid improvements. The fabrication techniques for this project are easy, and we would not need access to either the treadmill or the gait trainer for the fabrication process. Overall this design scored high due to the ease of techniques, and ability to use time for testing and finalizing the prototype.

Durability - The ramps and tracks connected design scored a 4/5 on the design matrix. The clamp itself has a long shelf-life and studies have shown that overtime they can experience permanent deformation, but the time period required for any slight deformation to occur is 6yrs. Additionally, since temperature is not changing, the deformation occurring is simply plastic deformation so the clamp can revert back to its original shape [4]. The track part of the system may wear down over time due to friction, but the extent of this is dependent on the material used for the track part of the design.

Design two: Ramp and Tracks disconnected

Safety- The ramp and tracks disconnected design scored a four out of five for the safety aspect. The design scored a high rating due to the strength of the mechanisms and accessibility if an emergency presented itself. The connection of the individual pieces allows strong stability and strength to keep the gait trainer in place. Additionally, the detached aspect allows the gait trainer to be pulled off the treadmill in case of emergency. The ramp follows ADA regulations[1],

allowing for the most safe option for entering the system. The risk of safety is the disconnection itself. The disconnection of pieces may allow for gaps. There is an increased risk of attachment due to the increase of connection system components.

Ease of use - The ramp and tracks disconnected design scored a four out of five in the ease of use category. Due to the fact that each track, and the ramp are all separate pieces, it makes installation and deinstallation much easier. Also, once the tracks are installed on the treadmill, due to the ramps detachability, the tracks can be left on the treadmill for as long as the client wants them there. The screws used to attach the ramp and the tracks are very simple to use as well. Overall due to the separate pieces of this design being detachable, it was scored higher than the other designs.

Cost - This design uses a wooden ramp and track system. A 19/32in x 4ft x 8ft sheet of plywood costs approximately \$40. Lumber such as a 2x4ft costs under \$5 [2]. Clamps such as a tiger clamp run under \$40 for a set of 4 [3]. The total cost of this design would be under \$300 which is significantly under our budget. This is a very affordable design option ranking it high.

Ease of fabrication - The ramp and tracks disconnected scored a four out of five. This project uses rather inexpensive material that is also fairly easy to alter. This is a scalable project that we would be able to make smaller prototypes to gain confidence in before the final prototype allowing for rapid improvements. The fabrication techniques for this project are easy, and we would not need access to either the treadmill or the gait trainer for the fabrication process. This design scored high due to the ease of techniques, and ability to use time for testing and finalizing the prototype. Overall, this design has a very similar fabrication process when compared to the connected tracks, and this is why they have the same score.

Durability- This design scored a four of five in the durability category. In this design, but unscrewing the system after every use, the only damage that could accumulate is due to the friction caused between the wheels of the gait trainer and the track. Similar to the connected tracks design, in order to see a significant amount of deformation and strain on the design, the product must be in use for an extended period of time, with this time amounting to years.

Design three: Altered Gait Trainer

Safety - The altered gait trainer design scored a two out of five for its safety. The altered gait trainer scored a lower design because of its lack of ramp system, lack of system to lock the wheels to the ground, and distance between the wheels and gait trainer. The lack of a ramp system prevents the client from stepping onto the treadmill with ease. Additionally, when on the treadmill with the altered gait trainer, there is no additional locking mechanism to prevent the

gait trainer from moving out of place. The distance between the gait trainer original wheel placement and clients feet can be approximately one inch apart. With the altered gait trainer, there would be a larger distance between the client's feet and original wheels.

Ease of use - The altered Gait Trainer design scored the lowest of the three designs, receiving a two out of five. This design requires the client and/or her caretakers to remove the wheels of the gait trainer each time the treadmill needs to be used, and replace them with taller wheels. Then additionally in order to be at floor level, the client would then need to have her gait trainer adjusted further. While this design would be simple once the wheels were switched out, the effort to remove and replace the wheels of the device multiple times a week would be very difficult. Overall this design is the most difficult to use and therefore was scored the lowest.

Cost - The altered Gait Trainer frame is made of steel and aluminum tubing [5]. These same materials should be used to make the modified base. Steel tubing costs approximately \$15 per 36in in length [6]. We would need no more than \$100 worth of steel tubing. Aluminum is lower in price than steel so if fabricated with aluminum it should cost less than \$100. The large tires would take up most of the budget with wheels and rims costing \$50-\$100 per tire as found on Amazon. This would put us at the very top of our budget. Since this uses most of the budget and has the potential to go over we gave it the lowest score of the three designs.

Ease of fabrication - The altered gait trainer scored a two out of five. Out of all of the designs, this is the only project that is altering the gait trainer, which means that this is the only project where not accessing the gait trainer puts us at a disadvantage. This project is also dealing with expensive material, which makes it hard to go through individual prototyping where we can decide pros and cons of fabrication techniques. On top of that, some of the fabrication steps for this project are difficult, such as welding the aluminum bars together. Overall, this project would be the least practical project due to accessibility of the gait trainer, and difficulty with the materials.

Durability- The altered gait trainer scored a two out of five for the durability category of the design matrix. In this design there will be an extra set of wheels attached to the gait trainer and due to the nature of the material of the gait trainer, the clamp will need to be extremely strong, which overtime will accumulate a high amount of stress and eventually deform. This design would be the least practical as the measures that would need to be taken to secure the clamp onto the gait trainer would result in a high amount of strain and stress in the system.

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