Concept Generation:

Improved Design of Mobility Devices

Team 526

Group Members:

Michael Beech
Dionsse Carti
Chase Craft
Leah Fiedler

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1.0 Morphological Chart

To help us brainstorm and come up with concepts, a morphological chart was used. The chart divides the overall design problem into simpler subproblems and highlights general solution concepts for each subproblem. Combining subproblem solutions down the chart creates different overall solutions for the project. This helps by allowing more versatility with our design and has helped us explore all of the possible relationships in this multidimensional problem.

Our morphological chart can be seen below in Table 1:

Table 1: Subproblem Concept Solutions

Sub-problems	**Sub-problem Solutions**			
	A	**B**	**C**	**D**
Body Connection	Hand/Forearm Support	Harness around waist	Thigh/Calf Braces	Seat/Platform to support weight
Propulsion	Motorized	User Input		
Frame Material	Aluminum	Steel	Polymer	
# of Ground Contact Points	1-point	2-points	3-points	4-points
Types of Ground Contact	Wheels	Pegs	Tracks	
Frame Type	Rigid	Linear Spring Suspension	Torsional Spring Suspension	Damper Suspension

Although this chart provides 1152 possible design combinations, we narrowed down approximately 96 solutions that we thought were the most applicable to our goals. Out of these narrowed down solutions, four of them were chosen to be further explained. Several of the solutions we considered had miniscule differences, such as switching from two (2) points of

contact to four (4) points of contact. These differences ultimately created a different design which accounted for the 96 solutions.

The selected designs were drawn out for better visualization and brief descriptions detailing each concept was included in this report. Before each drawing, the letters corresponding with the solutions to the subproblems are included. Referring back to the morphological chart can give a better understanding of the designs components.

1.1 Concept 1

Body Connection - **B**
Propulsion - **B**
Frame Material - **A**
# of Ground Contact Points - **D**
Types of Ground Contact - **A**
Frame Type - **B**

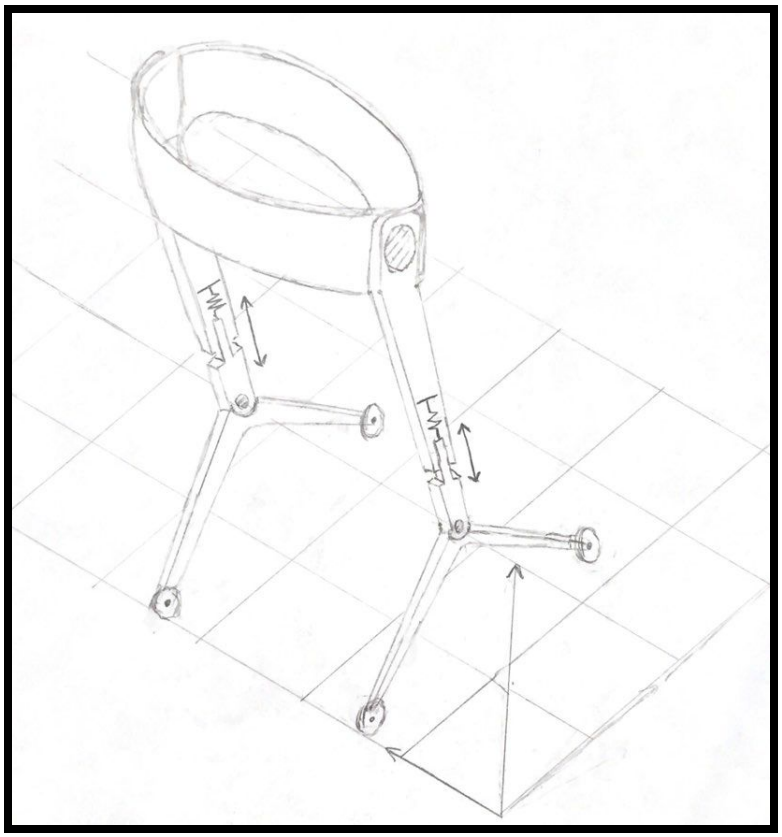

Figure 1. General view of concept 1.

This concept utilizes a waist harness connected to two linearly spring-loaded legs which are connected to two wheels each. This provides a four-wheeled base giving the user superior

support than fewer wheeled set ups. The waist harness diverts from your standard walker in that it removes the need to hold onto the device and instead supports some of the users weight by gripping them at the waist. This design will not only allow the user to use their hands for other things, but will also relieve the upper body of continuous stress that it is not designed for. By linearly spring-loading the legs the device will be able to follow the users up and down movements while walking and also reduce the impact on their joints.

1.2 Concept 2

Body Connection - **B**
Propulsion - **B**
Frame Material - **A**
# of Ground Contact Points - **B**
Types of Ground Contact - **A**
Frame Type - **C**

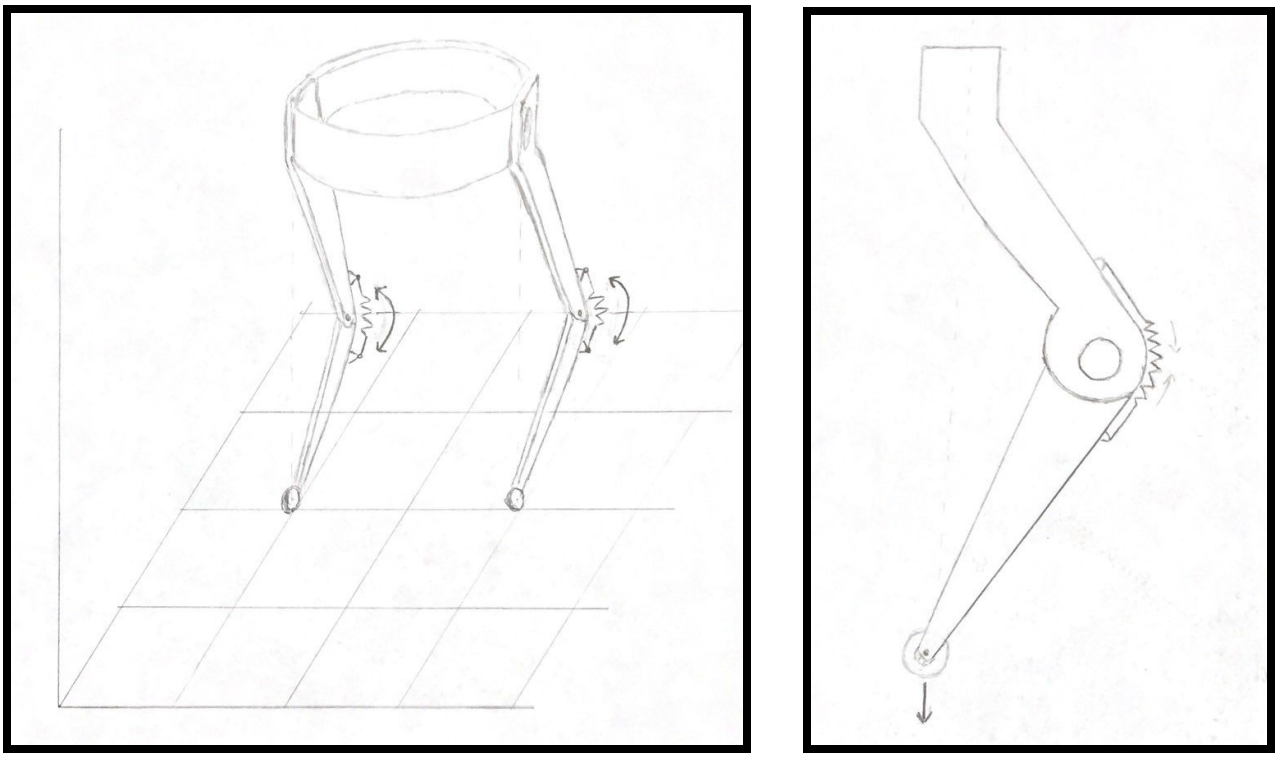

Figure 2. Concept 2 general view on the left and side view on the right.

Similar to the previous design concept, this concept implements a waist harness. However, instead of connecting the waist harness to a four-wheeled base, this concept connects the harness to a two-wheeled base. By utilizing a two wheeled base this concept may provide less stability to the user but will in turn give the user a much more compact and maneuverable

support mechanism. Also, due to the dual wheeled design, the type of suspension system implemented for this concept differs from the previous concept. This concept uses a torsional spring at each pivot point, as opposed to linear springs. This design does in fact provide less support than the similar previous concept, yet will result in a much simpler and cheaper final product.

1.3 Concept 3

Body Connection - **A**
Propulsion - **B**
Frame Material - **A**
# of Ground Contact Points - **D**
Types of Ground Contact - **A**
Frame Type - **C**

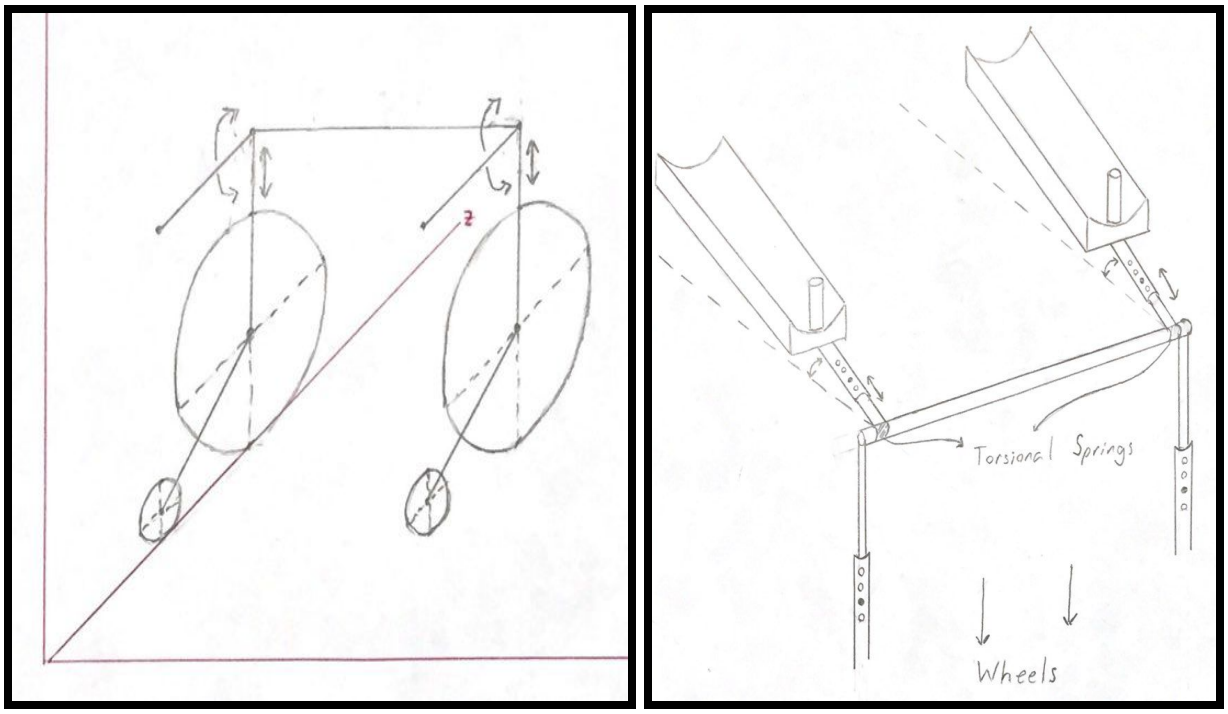

Figure 3. Concept 3 general view on the left and top section view on the right.

This concept implements a four-wheeled rigid frame connected to two torsionally spring-loaded, adjustable, arm rests. The four wheels provide more ground contact compared to the fewer wheeled options and therefore will provide superior support to a user. The arm rest, which have hand holds at the ends, will provide the user a more comfortable support and will also enable the user to hold more of their own weight, as opposed to solely hand grips. The armrest will also be linearly and torsionally adjustable which will allow the user to set the device

in numerous orientations. Finally, the armrests are connected to the rigid frame with a torsional spring. This spring-loaded design will equip the user with a basic suspension system in order to relieve impact on their joints while walking.

1.4 Concept 4

Body Connection - C
Propulsion - A
Frame Material - C
# of Ground Contact Points - B
Types of Ground Contact - B
Frame Type - D

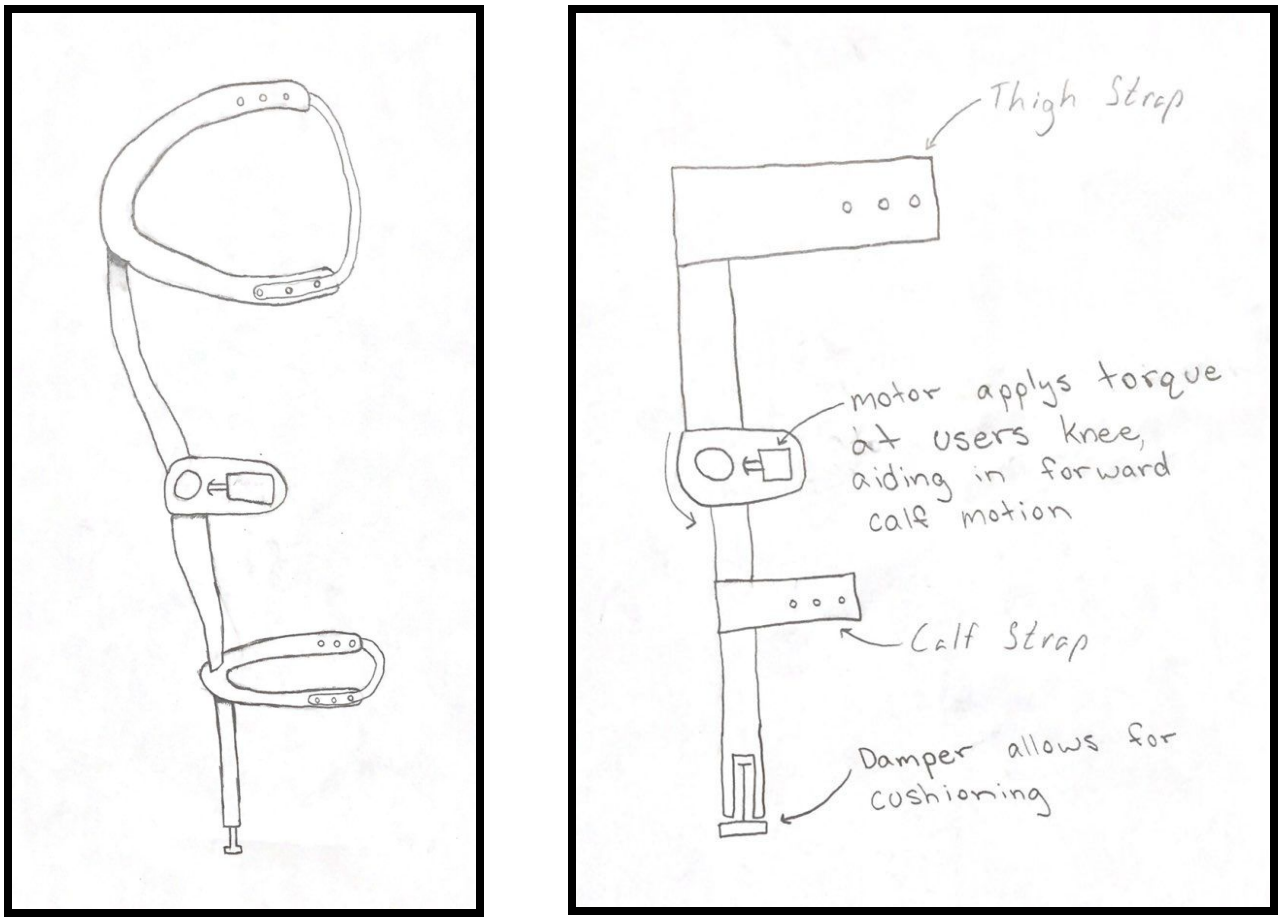

Figure 4. Concept 4 general view on the left and side view on the right.

The device runs along the left side of the left leg and the right side of the right leg. The device uses straps to enable a secure connection between the device and the user.. These strap to the thigh and calf of the user with a revolute joint at the location of the knee. The revolute joint

has a torsional input provided by the motor. The motor will activate when then user is doing a forward stride, accelerating the users calf without any effort by the individual.The device is supposed to touch the ground slightly before the individuals foot. There is one contact point per device so typical use will have two contact points. The device has a damper that through slowing the foots acceleration will decrease the forces on the joints of the user thus providing comfortable mobility. The material used is a polymer plastic so that it is lightweight and cheap.