Lerner Exoskeleton I

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Abstract

Our project was rooted in the modification of the already existing exoskeletons. The main function of exoskeletons is aiding the locomotion of older citizens. Through modification, our project has designed a better functioning and adjustable human gait rehabilitation. In addition to locomotion, this product will also reduce the problems associated with gait deformity. With a budget of approximately $1000, our design will ensure it has the best functionality by eliminating the deficiencies of previous exoskeletons including: their heavy nature, limited time of use and poor mounting design. The team designed different sizes for the foot plates to make them adjustable for the users.

Problem Statement

This project aims at improving on the current Adjustable Human-Exoskeleton Mounting Interface to an adjustable design that can be effectively mounted on the lower-extremity

Manufacturing

The team started to work with the machine shop (K&M) in the pre summer, and the team has provided the Machine Shop with the CAD package. By the first Hardware Review the team has completed 50% of the design, and by the second Hardware Review the team has accomplished the remaining 50% which contains the plastic sheet (frames) and the Velcro tape, etc.

Testing

One of our team members performed the testing procedure as shown Figure 2. This was done to ensure that the design met the requirements and that it was ready for use. For the foot portion, we used shoes and ensured that the length and width of the metallic parts were fit. It came out that our design allowed foot ankle bending, had relatively less weight , and that it did not cause much discomfort

Original System

Figure in the right corner shows the original adjustable human exoskeleton. Various designs have been developed to improve on this system.

Final Design

Figure 1 below shows a CAD model of the final design as well as the actual design.

Figure 1: Final Design

Figure 2: Final Testing

Requirements

	Requirements
Adjustable.	Use different sizes of footplates.
Easy to do on and off	Must be less than <20 sec.
Minimize skin irritation	Must use hypo allergic materials.
Lightweight.	Design should be < 0.75 kg.

References

A. Haptics, H. Kajimoto, H. Ando, and I. Kyung, K.-U. *Haptic interaction: Perception, devices and applications*, 2015, pp. 24-67.

K. Haruhisa, S. Ueki, S. Ito, and T. Mouri. "Design and Control of a Hand-Assist Robot with Multiple Degrees of Freedom for Rehabilitation Therapy", 2016.

Lecture 88. (2005). *Design of Unstiffened Cylinders*. Retrieved 11 April, 2017, from http://fgg-web.fgg.uni-lj.si/~/pmoze/esdep/master/wg08/l0800.htm

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