Exoskeleton

Alex Kernell, Colin Sellers, Nicholas Nocevski, AJ Peterson, Mahir Rahman

A. Team Composition:

Our team consists of Alex Kernell, Colin Sellers, Nicholas Nocevski, AJ Peterson, and Mahir Rahman. Alex is a senior majoring in Bioengineering with minors in Mechanical and Electrical Engineering. Alex will be the lead designer for the product and all of the mechanisms inside. He has thorough knowledge of the design process and is confident in his ability to make the design successful. Colin Sellers is a senior majoring in Computer Engineering with a minor in Computer Science. Colin will focus on the coding aspect of the project. He is highly skilled in developing software necessary for functionality and user interface. AJ Peterson is a senior majoring in Marketing with a Premedical Studies Co-Major. He will be responsible for providing the market analysis necessary to show the viability of the exoskeleton in the healthcare industry. Nicholas Nocevski is a senior majoring in Bioengineering. Nicholas is currently a research assistant, focusing on the engineering and applications of biological materials. He will assist in physical design and testing of the exoskeleton platform. Mahir Rahman is a sophomore majoring in Computer Science. Mahir has a good work ethic and a knack for problem-solving. He will assist in the coding and technical writing aspects of the project.

B. Problem Statement:

a. Definition of the Problem

Currently, there are millions of people in the United States alone who face mobility impairments. While bionic enhancements are available, the options are limited and expensive. Therefore, we are attempting to design a mechanical exoskeleton that will make use of augmented human mobility to reduce the metabolic cost of walking. With the exoskeleton, it would be more convenient and productive for people to go about their day-to-day activities.

b. Need Justification

The most common types of disability involve difficulties with walking or independent living. In the United States, more than 20 million people ages 18 and older reported having serious difficulty walking or climbing stairs in 2015, representing 7.1% of the civilian non-institutionalized population. Another 14 million people ages 18 and older reported having a difficult time doing errands alone (for example, shopping or

visiting a doctor) due to physical, mental or emotional conditions. Our technology enhances mobility for these patients and aids them in their day-to-day activities.

c. Success Criteria

The success of this project will be determined by the functionality of the prototype. Although some features may need further development to properly function, the basic features should be fully functional. These features include properly allowing the patient to stand and walk again with fully functional mobility and stability. We will also establish a full business plan with business metrics in place to track the success of our product.

C. Preliminary Idea:

Our product will use The Exoskeleton Drive GEN.1 which is designed for laboratory applications to test functions of the exoskeleton in an early development stage. With the high-power density motor and the robust aluminum housing, the drive can be used for knee/hip joints. For precise position feedback, the drive is equipped with a high resolution absolute encoder on the gearbox output. Our latest EPOS4 controller, with CANopen and USB interface, is integrated in the housing. The wide variety of different operating modes provide high flexibility in testing and optimizing the whole exoskeleton system. Moreover, braces will be attached to the motors to support the hip and legs, and straps will be included to maintain patient safety.

D. References

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