LOWER-LIMB POWER EXOSKELETON FOR HUMAN REHABILITATION AND MOTION ENHANCEMENT

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INTRODUCTION.

During the last decade, researchers have focused on the development of lower limb exoskeletons for users to run faster or travel long distances with heavy loads such as military and police personnel, as well as for rehabilitation of those elderly people or patients with disabilities caused by spinal cord injuries, acquired brain damage, cerebral palsy or post-polio syndrome. Exoskeletons are, in fact, a revolutionary idea to help especially paraplegics that are so desperately in need of new options to aid them in their recovery and everyday lives. Since the introduction of exoskeletons, the advantages are clear: exoskeletons will have a positive impact on the lives of paraplegics and their families. However, the high price and training requirements for their use create uncertainty as regards the number of people who will actually be able to benefit.

METHODOLOGY.

This project will develop one pair of electrically activated legs along with intelligent controllers to enhance walking pace as well as load carrying capacity of the person wearing it. It will consist of a set of pneumatic cylinders, joint actuators, and the structural components. The designed exoskeleton will have proper impedance matching human legs for comfortable enhanced motion of the user through gait analysis for normal and enhanced motion experiments. A mathematical model will be developed for dynamic stability analysis and controller design. Various sensors, such as accelerometers, rate gyros and others will be used to implement appropriate control actions for enhanced motion required. The outcomes of this research project will be a prototype of a pair of motor-actuated leg exoskeleton along with a real-time controller.

CONCLUSIONS.

The main advantage of the system also will be its ability to decouple the weight/mass carrying function from the forward motion function. This will release joint motors from supporting the weight of the user and provide just forward motion of the legs. Consequently, this will reduce the power and size of joint motors and thus the overall weight, cost and required electrical power for the system. Such lighter and cheaper devices are currently the main focus of an important engineering research area in medicine and military medicine [1].

REFERENCES.

1. L. Mertz. (2012). The next generation of exoskeletons, A Magazine of the IEEE Engineering in Medicine and Biology Society, 3(4): 56-61.