Bio-Inspired Electromagnetic Soft ExoMuscles for Rehabilitation and Assistive Technology Applications

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Technology description

This project will open up a whole new paradigm where these aritifical muscles can be used in developing soft prosthetics and anthropomorphic exoskeletons. For instance, by 3D scanning the patient's body and collecting the CAD data, a portable, bio-compatible and soft exoskeleton can be optimally designed for individual patient and worn as an active brace with direct contact with the skin, e.g. glove-like exoskeleton for hand injury and neck exoskeleton for ALS patients. These prosthetics and exoskeletons will be low cost, easy and safe to wear, even under the patient's clothing. Therefore, they won't highlight the disability of the patients as the current rigid and bulky exoskeletons would do. This approach will, therefore, greatly increase acceptance of wearable assistive devices by the disabled populations.

Invention Description

Wearable rehabilitation and assistive devices is a very important industry for millions of Americans as their products often change and greatly improve the standard of living for these Americans, making it a very important matter to have durable and trusty devices.The wearable rehabilitation and assistive devices industry falls short when it comes to devices that are powerful and scalable in nature. Many current devices are either powerful and active, but bulky and made of stiff rigid elements, such as those used in exoskeletons and prosthetics, or they are flexible and passive but with limited functionalities such as the design of the common joint and neck brace. This leaves a distinctive problem in the industry to fill a niche of a device that is both flexible and powerful while being both portable and comfortable for the user.
The primary issue holding back this development into a portable and powerful assistive device, is the lack of a soft, bio-compatible, and scalable electromagnetic actuator that can be used in joint active braces. Without an actuator with these characteristics it is incredibly difficult to produce a brace that is comfortable, portable, and easy to use. UTSA researchers have been developing a solution to this very problem.
UTSA Researchers are developing two different types of actuators, an actuator based on the use of solenoids, and an actuator based on the use of voice coils motors. Currently UTSA researchers have a working prototype of the solenoid based actuator. This prototype has shown promising results in terms

of flexibility, bandwidth, and even output force to size ratio. Additionally, the results showed that in these actuators, as the size decreased, the force to volume ratio increased, and fortunately, these actuators, because of their form factor, are highly scalable, which in turn means that they can be designed down to sub-millimeter sizes by using a photonic high-resolution 3D printer, which is ideal for the true goal of this research.
The fundamental purpose of this research is to develop a joint active brace that is powerful and flexible, inspired by actual skeletal muscles in shape and functionality. By creating an actuator that is small and functional enough, they can be arranged in a way to resemble an actual fiber of muscle, think of the actuators as a building block to the development of an entire "ExoMuscle." Thus, with the development of an artificial muscle that has the ability to contour to the users own body, we can solve every issue commonly associated with these assistive devices and prosthetics solely because of its unique and functional design.

Application area

Intended for the disabled, injured, and others in need of assistive prosthetics.

Advantages

Comfortable:Joint active braces are designed to be intrinsically soft, bio-compatible and operated with on-board batteries. As opposed to the often rigid and hard structure of other exoskeletons and prosthetics.
Scalable:The actuators developed are highly scalable, which means they can be narrowed down to even the sub-millimeter level.
Portable:Because of the actuator's scalable nature, and with the use of on-board batteries, we can develop a far more portable "ExoMuscle" that is additionally just as functional as contemporaries.

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