Smart Exoskeleton Glove

VTIP 20-054: “Intelligent Hand Exoskeleton with Grasping Assistance”

THE CHALLENGE

Numerous diseases affect the mobility of the human hand including stroke, brachial plexus injury, arthritis, or carpal tunnel syndrome. In the United States, at least 1.1 million people report difficulty performing ordinary grasping operations, heavily reducing their economic outlook. In some cases such as stroke, rehabilitation is possible through repetitive motion in the affected area whereas injury to the brachial plexus cannot be fully remedied even with surgical intervention. In these types of cases, continual assistance is needed to restore mobility to the hand.

OUR SOLUTION

Virginia Tech researchers from the Department of Mechanical Engineering have developed a nine degree of freedom exoskeleton glove that is capable of reproducing all grasping tasks present in ordinary activity. The device is easily modifiable to fit individuals with differing hand sizes. The series elastic actuators used to move the finger joints allow for compliance while the structure of the glove incorporates the finger as a member of the mechanism. Both of these design choices heavily increase the comfort, and therefore attractiveness, of the exoskeleton. The user-driven control scheme requires no additional hardware such as cameras or EMG sensors, but relies on the movements, even weak movements, of the user leading to intuitive naturalistic operation. Comfort and usability are further enhanced by the intelligent assistance which prevents uncomfortable motion beyond the natural range of motion of the fingers while reacting very quickly to the user’s physical input. The device is therefore more operable and comfortable than other state of the art exoskeleton gloves while reducing the amount of effort for grasping.

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