A Pneumatically Actuated Soft Physical Interface

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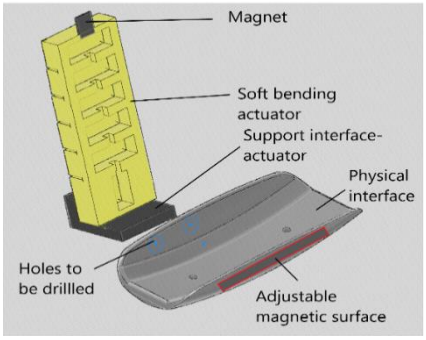
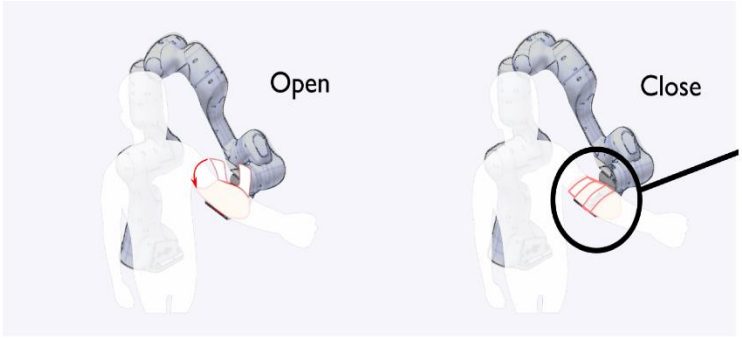
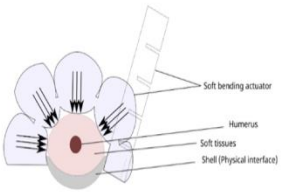
Wearable robots possess great potential for diverse applications such as power augmentation, preventing musculo-skeletal disorders in the workplace and especially rehabilitation. The physical interface, the connection between the user and the wearable robot, plays a critical role in determining the level of assistance provided and the comfort experienced by the user. However, proper placement and attachment of the physical interface requires a certain level of expertise from therapists, which can be expensive and unfeasible in the long run. This poses a significant challenge for users with motor disabilities who face difficulty in donning the straps and adjusting their tightness due to their motor limitations or sensory impairment. To address this issue, an automatic donning and control system is required. Until recently, the idea of self-attaching autonomously wearable robots remained in the realm of science fiction. In this project, we aim to develop self-donning exoskeletons that hold great potential in relieving therapists and patients of the burden of complicated donning procedures.







As a thesis student on this project, your goal will be to design an active interface for a custom-made upper-body exoskeleton physical interface. First, you will make new CAD design and manufacturing processes in order to assemble all components (magnet, 3D-printed support between the actuator and the interface, screws to assemble the support with the interface, magnetic surface to define initial strapping pressure, etc.) and have the active physical interface ready for testing with a specific actuator and physical interface (as shown in the figures above). Furthermore, you will develop a control strategy using compressed air available in the lab to check if the straps are securely holding the limb of interest. You will test your prototype on a healthy subject, collect data, and process it.

Your tasks: Designing a novel way to safely, quickly, and autonomously don/doff the user, implementing the final prototype on a human subject, controlling pressure to enclose the limb, and testing the final prototype on a human subject.
Requirements : Self-motivated, CAD design (Inventor/Solidworks), manufacturing (3D printing, drilling, etc.) programming (Arduino, Python), data processing (Matlab), Simulation (Simulink).

Please contact us for more information before choosing the project.