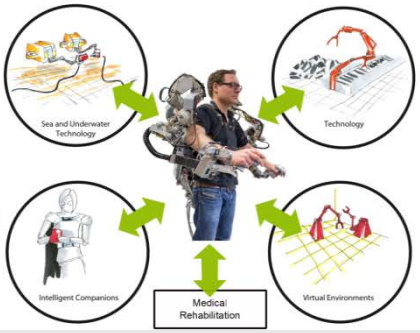
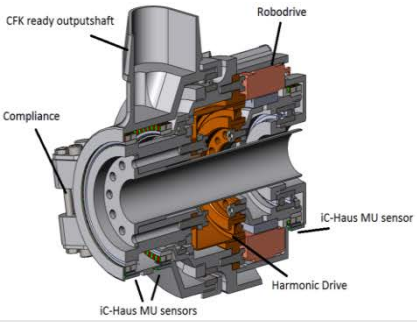
German Research Center for Artificial Intelligence

Upper Body Exoskeleton for Teleoperation

A teleoperation scenario



CAPIO application scenarios



CAD model of the exoskeleton actuator

A New Concept for Teleoperation

Remote controlled robots are indispensable tools for exploration and operation in environments that are e.g. highly risky or unsuitable for human beings. According to this demanding and diverse applications the machines, their action spaces and their tasks have reached a level of complexity that makes it increasingly difficult for operators or state-of-the-art artificial intelligence systems to control them.

Following these challenges and based on the findings of the VI-Bot project, the CAPIO project aims at developing a universal, wearable, lightweight upper body dual-arm exoskeleton applicable for teleoperation tasks. Furthermore, the dual-arm exoskeleton has to meet requirements like high dynamics of the actuation system and adequate force interaction. The kinematic structure covers most of the human upper body degrees of freedom and shall be adaptable to users with different body sizes. The design of the exoskeleton based on a bio-mechanical model of the human upper body will advance the current state-of-the-art in mechatronics, control and kinematic mapping.

To allow precise measurement and control of forces in a lightweight structure, new materials need to be used, which facilitate the embedding of sensors and actuators. Moreover, the control system fulfills all necessary requirements like safety, stability, and adaptability. New approaches that integrate bio-signals to anticipate actions of either the limbs or the target robotic system and adapt to complex dynamics behaviors will be investigated.

The system can be used in various teleoperation applications that differ in their kinematic structure, in their connection to the master (in terms of latency and bandwidth), and their manipulation purpose. Finally, the exoskeleton system developed in CAPIO will offer a unique set of new technologies that can be used to improve the robotic rehabilitation field. A study on robot-assisted rehabilitation is the basis for further research projects in this area.

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