ExoShirt

User-centered design of a textile active exoskeleton with integrated passive support structures

BACKGROUND

Back pain and musculoskeletal disorders in the back, are among the most common causes of incapacity for work and severe disability in Germany. In order to combat these problems, the aim of the project is to develop an exoskeleton that enables natural and intuitive movements and supports the human body during ergonomically stressful activities. It focuses specifically on activities that place strain on the upper body in industrial workplaces. The support should be adapted to the situation. In order to fulfill this task, not only empirical values are used, but also neural networks for the automated recognition of movement and posture patterns, which is intended to increase usability and effectiveness. The individual relief of the user will be achieved through the integration of customizable actuator elements, which are developed in the project based on the jamming principle, into the textile base structure.

FOCUS OF WORK

On the one hand, **AAS** is developing the design of the system with a biomimetic shape, including the arrangement of sensors and actuators as well as the control by neural networks. On the other hand, **Autoflug GmbH** is responsible for the development and integration of the actuators into the functional textiles as well as the control and energy supply. The research and development project will be carried out step by step and evaluated regularly. Functional models or early stage prototypes are built in the early development phases, which are evaluated and validated with potential users in a co-design process including laboratory and practical tests. The Exoshirt is developed specifically with regard to requirements for industrial applications in order to ensure maximum performance. With the help of real-time data provided by integrated sensors, the system should be able to adapt to different situations and movements in real time in order to provide optimal stabilization of the upper body at all times.

KEY MESSAGES

A textile, active and switchable exoskeleton is being developed as part of the innovation project. To this end, innovative actuators with variable stiffness are aimed to be constructed. Additionally, passive support structures are integrated into a functional textile material with a biomimetic design. The control of the variable stiffness of the actuators is based on motion and posture recognition using machine learning algorithms. The project partners, **AAS** and **Autoflug GmbH**, are working together on the successful realization of a prototype.

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