disorders while conducting high intensity and long term installation works. However the automation equipment cannot always solve the problems for companies in industrial sector, and industrial workers cannot completely be replaced by these equipment. A mechanical Unpowered Upper Extremity Exoskeleton to reduce the fatigue of the upper extremity muscles is proposed. The purpose of this study is to find out whether the exoskeleton can effectively lower the risks of musculoskeletal disorders by reducing the fatigues.

Methods: Ten volunteers as the test subjects participated in the experiment to test the exoskeleton by lifting a hand-held tool weighing 5 kg. Each subject maintains his/her upper extremity at a fixed position with a certain angle when grasping the tool. A FlexComp Infiniti surface electromyography (EMG) system was used to acquire magnitudes of the muscles that are assisted both with and then without the support from the exoskeleton during the manual handling tasks. The EMG data acquired from the experiment were then used for analysis.

Results: The results showed that the fatigues in brachioradialis, biceps brachii and deltoid are significantly reduced ($P < 0.05$), and the reduction is quite obvious. The average normalized RMS of brachioradialis was reduced 27.01% with the exoskeleton in-use compared to not-in-use. The average normalized RMS of biceps brachii was reduced 150.26%. The average normalized RMS of triceps was reduced 36.59%. The reduction of the normalized MPF of the tested muscles with the exoskeleton are much smaller than without the exoskeleton - Respectively: 10.3% (biceps brachii), 7.8% (deltoid), 7.1% (triceps) and 12.0% (diaphragm).

Conclusions: Unpowered Upper Extremity Exoskeleton can significantly relieve the worker's stresses on the brachioradialis, biceps brachii, deltoid, and triceps by partially taking the load of the tool for the workers, and also transferring the load to the ground. The use of the exoskeleton does not only decrease fatigues of upper extremities, but also significantly increase the work efficiency by reducing the risk from the development of musculoskeletal disorders. Thus the workers can focus on the manipulation and installation during their work tasks.

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069 | Biometrics for Personalised Autonomous Driving

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Objectives: This study was designed to understand how well users perceive their biometric data can personally identify them in driving behaviour and their willingness to disclose their biometric data for personalising autonomous driving.

Methods: A scenario-based laboratory study was conducted with 27 human drivers in a driving simulator. The drivers were instructed to experience two driving conditions, i.e., manual driving and personalised autonomous driving. A biometric data collection platform was used to capture their biometric data including heart rate, skin temperature, and eye movements outside and inside the simulator. Besides, a camera system was developed to detect and collect their facial expressions, postures, and physical activities. After the driving tasks, they were interviewed and surveyed regarding how well they perceive their biometric data can personally identify them in driving behaviour and their willingness to disclose the information for personalised autonomous driving.

Results: Biometric data including eye movements, postures, and physical activities were the top three items chosen by the participants to be good at identifying themselves in driving behaviour, followed by facial expression, heart rate, body temperature, and voice in order. They expressed their surprise about the amount of personal information that could be collected during the driving and the corresponding concerns about privacy and security issues of such information. In general, they were willing to have the information on heart rate, body temperature, posture, physical activity, and eye movement to be collected and shared. For data of voice and facial expression, they were found to be more conservative and wish to keep them confidential.

Conclusions: The finding implies a collection and sharing limitation in autonomous driving, which is about having a limit control for users to specify which data can be collected and shared within specific contexts. It also suggests making the collection and sharing of biometric data and vehicle personalisation in autonomous driving transparent to users to ensure that they understand and are willing to accept the risk/reward of using their data via biometric system.

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