EXOSKELETON FOR LUMBAR SUPPORT (IUVO/SANT'ANNA)

Involved partners

IUVO

LMS Laboratory for Manufacturing Systems & Automation

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Video

https://bit.ly/43QanKT

EXOSKELETON FOR SUPPORT OF SHOULDER FLEXION (IUVO/SANT'ANNA)

Technology

Exoskeletons are wearable mechanical devices designed to provide support to workers by reducing their physical effort. Two occupational exoskeletons, namely a shoulder-support exoskeleton and a lumbar-support exoskeleton, were developed within Mari4_YARD project. Their ultimate goal will be to reduce physical strain of workers in those production stages characterized by the presence of wearing job movements for the shoulder girdle and the spine, respectively. The shoulder-support exoskeleton is designed to provide antigravitational support to the user's arms for those job activities requiring static or repetitive shoulder flexion. Thanks to an embedded battery-operated control unit, the exoskeleton is capable to adjust the provided support depending on the inherent effort of the working activity though effort-based and perception-based adaptive algorithms. The lumbar-support exoskeleton is designed to support the user's trunk erector muscles through an assistive action delivered at the level of the lumbo-sacral joint in those job activities requiring repetitive load lifting actions or static flexion trunk poses. The intensity of the assistance level can be manually tuned over five levels. As "wearable" tools, both exoskeletons are designed to provide a comfortable human-machine interaction thanks to a light-weight structure, high kinematic compatibility ensuring for complete freedom of movement and high adaptability thanks to a set of adjustments mechanisms that allow to tailor the size of the devices to fit on specific users. Both exoskeletons are also endowed with a control unit that is devoted to acquiring kinematics information from an integrated sensory apparatus and implementing wireless MQTT protocol to share information with IoT networks.

Applications

Exoskeletons have gained attention in recent years as a potential solution for reducing workplace injuries and improving productivity in physically demanding jobs. While automation is often heralded as a solution in industries that require repetitive or heavy manual labor, many shipbuilding working activities require flexibility, adaptability, or sensitivity to navigate and operate in complex environments. This is where exoskeletons result useful advanced tools for supporting workers improving ergonomics in those activities that require prolonged static postures or repetitive movements that can cause musculoskeletal discomfort.

Impact (including target/users and benefits)

Occupational exoskeletons for shoulder and lumbar support are attracting attention of several stakeholders given their potentiality to prevent work-related musculoskeletal disorders. Several studies conducted in successful use-case applications demonstrated efficacy of exoskeletons in reducing the biomechanical overload of the assisted district. Preserving industry-specific workers' knowledge, skills and biomechanics health status is essential for the competitiveness of small and medium-scale shipyards. Lowering physical strain, assistive exoskeletons are expected not only to improve safety and ergonomics of the working condition but also to impact quality and productivity enhancing precision and avoiding fatigue-induced errors.