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Physiological Data Monitoring of Physical Exertion of Construction Workers Using Exoskeleton in Varied Temperatures

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1. Abstract

Annually, several construction workers fall ill, are injured, or die due to heat-related exposure. The prevalence of work-related heat illness may rise and become an issue for workers operating in temperate climates, given the increase in frequency and intensity of heatwaves in the US. An increase in temperature negatively impacts physical exertion levels and mental state, thereby increasing the potential of accidents on the job site. To reduce the impact of heat stress on workers, it is critical to develop and implement measures for monitoring physical exertion levels and mental state in hot conditions. For this, limited studies have evaluated the utility of wearable biosensors in measuring physical exertion and mental workload in hot conditions. In addition, most studies focus solely on male participants, with little to no reference to female workers who may be exposed to greater heat stress risk. Therefore, this study aims to develop a process for objective and continuous assessment of worker physical exertion and mental workload using wearable biosensors. Physiological data were collected from eight (four male and four female) participants performing a simulated drilling task at 92oF and about 50% humidity level. After removing signal artifacts from the data using multiple filtering processes, the data was compared to a perceived muscle exertion scale and mental workload scale. Results indicate that biosensors' features can effectively detect the change in worker physical and mental state in hot conditions. Therefore, wearable biosensors provide a feasible and effective opportunity to continuously assess worker physical exertion and mental workload.

Key words: Exertion, Construction Automation, Wearable Devices, Heat stress, Mental workload