

Real-Time Working Environment Risk Analysis with Smart Textiles

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Abstract : Despite new recommendations and guidelines for the evaluation of occupational risk assessments and their prevention, work-related musculoskeletal disorders are still one of the biggest causes of work activity disruption, productivity loss, sick leave and chronic work disability. It affects millions of workers throughout Europe, with a large-scale economic and social burden. These specific efforts have failed to produce significant results yet, probably due to the limited availability and high costs of occupational risk assessment at work, especially when the methods are complex, consume excessive resources or depend on self-evaluations and observations of poor accuracy. To overcome these limitations, a pervasive system of risk assessment tools in real time has been developed, which has the characteristics of a systematic approach, with good precision, usability and resource efficiency, essential to facilitate the prevention of musculoskeletal disorders in the long term. The system allows the combination of different wearable sensors, placed on different limbs, to be used for data collection and evaluation by a software solution, according to the needs and requirements in each individual working environment. This is done in a non-disruptive manner for both the occupational health expert and the workers. The creation of this solution allows us to attend different research activities that require, as an essential starting point, the recording of data with ergonomic value of very diverse origin, especially in real work environments. The software platform is here presented with a complimentary smart clothing system for data acquisition, comprised of a T-shirt containing inertial measurement units (IMU), a vest sensorized with textile electronics, a wireless electrocardiogram (ECG) and thoracic electrical bio-impedance (TEB) recorder and a glove sensorized with variable resistors, dependent on the angular position of the wrist. The collected data is processed in real-time through a mobile application software solution, implemented in commercially available Android-based smartphones and tablet platforms. Based on the collection of this information and its analysis, real-time risk assessment and feedback about postural improvement is possible, adapted to different contexts. The result is a tool which provides added value to ergonomists and occupational health agents, as in situ analysis of postural behavior can assist in a quantitative manner in the evaluation of work techniques and the occupational environment.

Keywords : ergonomics, mobile technologies, risk assessment, smart textiles

Conference Title : ICMR 2018 : International Conference on Manufacturing Research

Conference Location : San Francisco, United States

Conference Dates : June 06-07, 2018