

Real-Time Kinetic Analysis of Labor-Intensive Repetitive Tasks Using Depth-Sensing Camera

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Abstract : The musculoskeletal disorders, also known as MSDs, are common in construction workers. MSDs include lower back injuries, knee injuries, spinal injuries, and joint injuries, among others. Since most construction tasks are still manual, construction workers often need to perform repetitive, labor-intensive tasks. And they need to stay in the same or an awkward posture for an extended time while performing such tasks. It induces significant stress to the joints and spines, increasing the risk of getting into MSDs. Manual monitoring of such tasks is virtually impossible with the handful of safety managers in a construction site. This paper proposes a methodology for performing kinetic analysis of the working postures while performing such tasks in real-time. Skeletal of different workers will be tracked using a depth-sensing camera while performing the task to create training data for identifying the best posture. For this, the kinetic analysis will be performed using a human musculoskeletal model in an open-source software system (OpenSim) to visualize the stress induced by essential joints. The "safe posture" inducing lowest stress on essential joints will be computed for different actions involved in the task. The identified "safe posture" will serve as a basis for real-time monitoring and identification of awkward and unsafe postural behaviors of construction workers. Besides, the temporal simulation will be carried out to find the associated long-term effect of repetitive exposure to such observed postures. This will help to create awareness in workers about potential future health hazards and encourage them to work safely. Furthermore, the collected individual data can then be used to provide need-based personalized training to the construction workers.

Keywords : construction workers' safety, depth sensing camera, human body kinetics, musculoskeletal disorders, real time monitoring, repetitive labor-intensive tasks

Conference Title : ICOHS 2020 : International Conference on Occupational Health and Safety

Conference Location : Miami, United States

Conference Dates : March 12-13, 2020