



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

This study aims to design a simple, inexpensive, and safe transfer assistive device with a focus on introducing a new research direction in the field of assistive technology devices through a context-driven research approach during concept selection, evaluation and development process. An alternative design methodology was executed and adopted to explore the interaction between the user and the current device and generate integrated human-machine design conceptualization and evaluation strategies. Custom biomechanical assessment methods for human-machine interaction were synthesized to evaluate the device's safety and usability. A working prototype was developed, and an EMG-based experimental validation was conducted on the selected potential participants to examine the functionality of the developed transfer assistive device. The study's main contributions are: an alternative biomechanical loading prediction equation was formulated to determine the compressive loads at the L5/S1 lumbar spine for any load and handle orientations, which would be helpful in the early estimation of musculoskeletal disorders in a similar product. A simple alternative methodology for identifying an optimum handle design and orientation was presented using a human-machine approach based on the EMG data recorded during the experiment, and a new technique was also presented for the effective selection of an optimum actuator load and its location in the context of human-machine design. Additionally, three findings were also obtained from this experiment, which may be useful for ongoing related studies, such as (1) the compressive load at the spine largely depends on posture than the hand load, (2) BR muscles had the highest contribution in the FPT tasks, in contrast AD muscles was shown to have lowest contribution. (3) the formulation of a predictive equation for estimating the spine load that might help in evaluating the handle design in a similar product. Generally, a transfer assistive device employing a precisely selected component was developed that was able to transfer users in a biomechanically accepted transfer posture.