

Accepted Manuscript

Instrumented measurement analysis system for soldiers' load carriage movement using 3-D kinematics and spatio-temporal features

D.N. Filzah Pg Damit, S.M.N. Aroscha Senanayake, Owais A. Malik, Pg Norjaidi bin Pg Tuah

PII: S0263-2241(16)30565-6
DOI: <http://dx.doi.org/10.1016/j.measurement.2016.10.017>
Reference: MEASUR 4379

To appear in: *Measurement*

Received Date: 14 October 2015
Revised Date: 20 July 2016
Accepted Date: 7 October 2016

Please cite this article as: N.F.P. Damit, S.M.N. Aroscha Senanayake, O.A. Malik, P.N.b. Tuah, Instrumented measurement analysis system for soldiers' load carriage movement using 3-D kinematics and spatio-temporal features, *Measurement* (2016), doi: <http://dx.doi.org/10.1016/j.measurement.2016.10.017>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



INSTRUMENTED MEASUREMENT ANALYSIS SYSTEM FOR SOLDIERS' LOAD CARRIAGE MOVEMENT USING 3-D KINEMATICS AND SPATIO-TEMPORAL FEATURES

D. N. Filzah Pg Damit^{a,b}, S. M. N. Arosha Senanayake^{a,*}, Owais A. Malik^a, Pg Norjaidi bin Pg Tuah^a

^a Faculty of Science, Universiti Brunei Darussalam, Tungku Link, Gadong, BE 1410, Brunei Darussalam

^b Human Performance Lab, Performance Optimisation Centre, Ministry of Defence, Bolkiah Garrison, BB 3510, Brunei Darussalam

ABSTRACT

A comprehensive measurement analysis of soldiers' gait and motion during prolonged loaded march is vital in order to analyse the consistency of soldiers' performance during combat and training. Prolonged loaded march has been reported to cause fatigue and overuse injuries to the trunk and lower extremity, thus inhibiting soldiers to attain their optimal performance. A motion capture system, considered as the reference standard in motion analysis, is used in a controlled environment for this research. Data were collected from 10 healthy male soldiers (26.3 ± 5.8 years old), performing load march on treadmill at 6.4 km/h (1% elevation) while carrying 15 kg loaded military backpack for 30 minutes. The study was able to address the complete 3-dimensional measurement analysis of soldiers' gait (kinematics and spatio-temporal data), heart rate and their perceived exertion. Different kinematic features such as angular changes and range of motion in critical joints; ankle, knee, hip, pelvis and trunk, integrated with the spatio-temporal features; physiological data such as heart rate (HR) and subjective responses such as rating of perceived exertion (RPE) at critically important gait events were examined. The results prove significant changes ($p < 0.05$) in kinematic features such as angular changes of ankle joint at frontal plane during toe-off and angular changes of knee joint at transverse plane during all gait events, including significant increase in HR and RPE values towards the end of the load carriage trial. The study was able to identify which critical joint at a particular plane and gait event that was affected first and most significantly by the load carriage trial. It has also shown that due to the load weight, speed and duration of the task that is routinely used in military training and soldier fitness regime, subjects were able to consistently replicate their kinematic patterns throughout the experimental task.

Keywords: Motion Capture System, Load Carriage, Gait Analysis, Kinematics, Military

1. Introduction

Gait analysis is the systematic study of human walking aimed at quantification and understanding the locomotion process [1] which involves the observation of body movements, mechanics and muscle activities. Gait analysis is typically carried out for clinical purposes such as discriminating between normal and abnormal gait and to assess changes in walking over time [2] but it can also be used to enhance

*Corresponding author.

Email address: arosha.senanayake@ubd.edu.bn

Download English Version:

<https://daneshyari.com/en/article/5006960>

Download Persian Version:

<https://daneshyari.com/article/5006960>

[Daneshyari.com](https://daneshyari.com)