Biomechanical Analysis of Digital Human Models: A Posture & Motion Validation study with Santos

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Abstract

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Validation of posture and motion of Santos digital human model is one of the various studies planned in the research design. For this purpose, we plan to recruit 50 healthy participants(25 male and 25 female, with no pathlogical disorders). 58 reflective markers were placed at selected portions of the body, keeping in view the biomechanics of the body parts. The subjects were then brought to the arena which was previously calibrated to minimize error due to dropped markers and phantom markers(e.g. interfereing reflective objects).Range of motion data was collected for all major joints.Single and multiple effector reaching tasks were then performed. For all assessments , three repetations were taken and the values were recoreded. The data was then processed and thus used for further analysis.

Introduction

Human motion capture system has always been used in medical fields and animation industry. Virtual Simulation,ergonomics and human factors studies are the recent areas where this technology is being applied. In this system, we record the movements of a live human and store the movements in a digital format. Current technologies and systems for capturing human motion include mechanical "exoskeleton" systems, optical and video camera systems, magnetic sensors, reflective markers and data gloves.

Objective

Our basic objective is to validate the posture and motion prediction of upper and lower body. Further, we would validate the posture and motion prediction of whole body and also from basic fundamental tasks (i.e. push , pull etc)to more complex tasks.

Methods

An optical motion capture system(Motion Analysis,Santa Rosa, CA) will be used to capture subjects' motions during tasks. Data will be sampled at 60 Hz for each task.12 cameras are used to capture the motion during the trials. Small markers (one fourth to one inch diameter)will be fixed to the skin and clothing of the participant using recomended procedures. Marker surfaces will be covered with retroreflective tape allowing cameras to track marker positions within a three dimenional volume.

Results

There are basically 3 steps for motion comparision:

1- data acqusition

Motions can be described based on various parameters (joint angles, velocity and acceleration of the joint/ limb movements, etc). So,we make a kinematic model of body segment links is created and acquired motion capture data is applied to drive the motion of the model.

2- data comaparison

Human data collected are either static or dynamic. Comparison of rotation and displacement of selected joint is done, by analysing the movement of markers, with the corresponding information generated by Santos.Virtual markers can be placed to Santos and movements is compared withh obtained data sets

3- model fitting

No model (or prediction) is perfect, but we can asses the degree of fit. Intra and inter - person variabilties are the major sources of error while dealing with human motions. Assesment is first done subjectively by ergonomic analysis. Then, qualitative assesment is done by appearance and predicted motions.

Conclusions

Data collection is in progress and we are in processing stage of our study. After proper and rigourous analysis only we can conclude our results about the validation study of Santos.