Mihir Gawand

ME 599: Project Proposal

1. Background

Digital Human Modeling (DHM) is a method widely used in today's research to integrate the aspect of human factors in the early phases of design. This methodology eliminates the need of a traditional human mock-up simulation to understand human physiological aspects that should be considered while designing a product that requires human interaction. The traditional method is often time consuming and expensive as it needs physical prototypes, human subjects & IRB approvals to conduct experiments with humans. DHM helps in integrating humans in the digital environment e.g. CAD models which eliminates the need of a physical prototype. Thus it is less time consuming and is a cost effective method.

2. Current Approach

Currently there are a few DHM software that are being used exclusively like Jack, Santos etc. This DHM software have access to different human anthropometries depending on sex and geographical region. They use inverse kinematics to make the digital human perform different tasks such as grasp an object, walk, and reach a surface. The postures while performing this tasks are analyzed and an evaluation report is provided that helps to assess; whether the postures are comfortable, moments/forces are acting on the joints and other ergonomic evaluations. However the task assigning method is quite cumbersome as the user has to select the task sequence each time. Also, when the user has to consider different anthropometries and different designs then it is not an effective method as it will be very time consuming to consider each anthropometry, create task simulations and then evaluate the designs accordingly.

3. Proposed Work

As you can see from the current approach that automation is one of the limitations in this case especially when it comes to testing 100s of design for 1000s of different anthropometries. For this project, I will be focusing on Jack 8.4 Siemens which is a Digital Human Modeling software available on the PCs in our school and is the one I am working on for my research. Also, Jackscript which is a scripting language for Jack toolkit is written in Python. I would like to write a Python script that generates the task sequence for a specific product and automates the process of building the task simulation. The next thing it will do is generate ergonomic reports for the task sequence for each anthropometry and also if possible for different designs of the same product. The ergonomics report data can then be compared and can be used to find the optimum anthropometry and optimum design of the product.

4. Evaluation

The code will be tested by building task simulations manually for a few combinations (anthropometry and designs) and comparing the results generated with the ones generated by the code for the same combination. Also, the videos of the task simulation sequence can be saved in Jack and thus it will be possible to check if the code is doing the right thing.

5. Deliverables and Grading

I would like to author the action sequence, and output a text script, that will call task simulator to perform the simulation for each action and will generate the ergonomic report.

Grading rubric: Successfully and accurately run the task sequence - 50%; Generate accurate ergonomic results – 30%; Find the optimum anthropometry and/or optimum design – 20%.