THREE DIMENSIONAL VISUALIZATION OF THE STATICALLY EQUIVALENT SERIAL CHAIN FROM KINECT RECORDING

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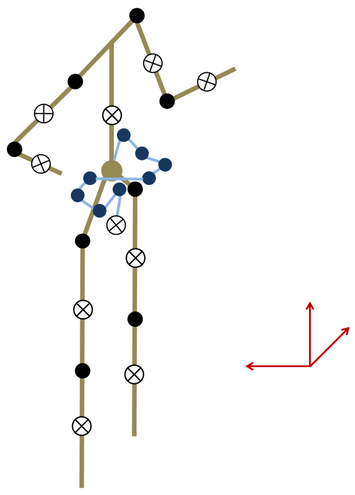

FIGURE 1: Tree-chained representation of a human body and its SESC.

TABLE I: Rmse[mm] of the projected CoM against measured CoP.

	Sb01		Sb02	
	x-axis	*z-axis*	*x-axis*	*z-axis*
SESC	23.06	28.67	20.22	25.47
Winter	55.95	141.61	26.12	55.42

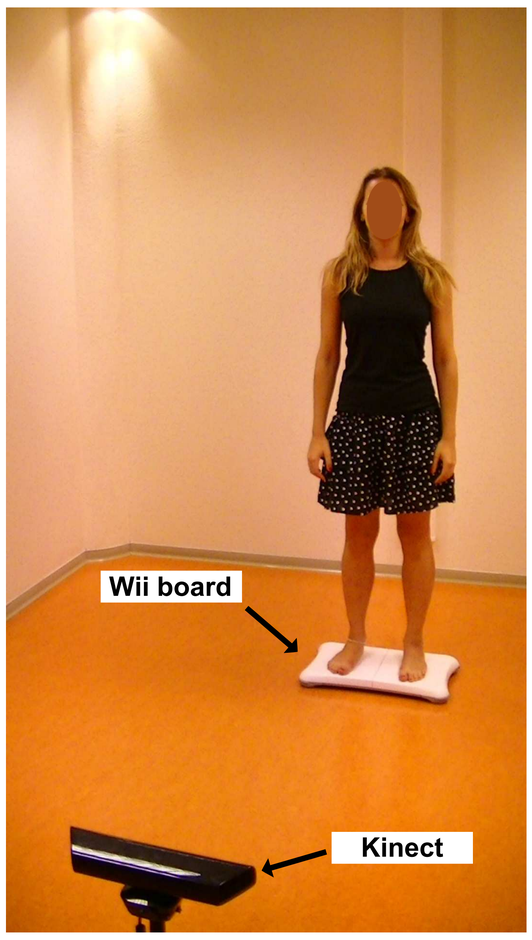

FIGURE 2: Experimental set up.

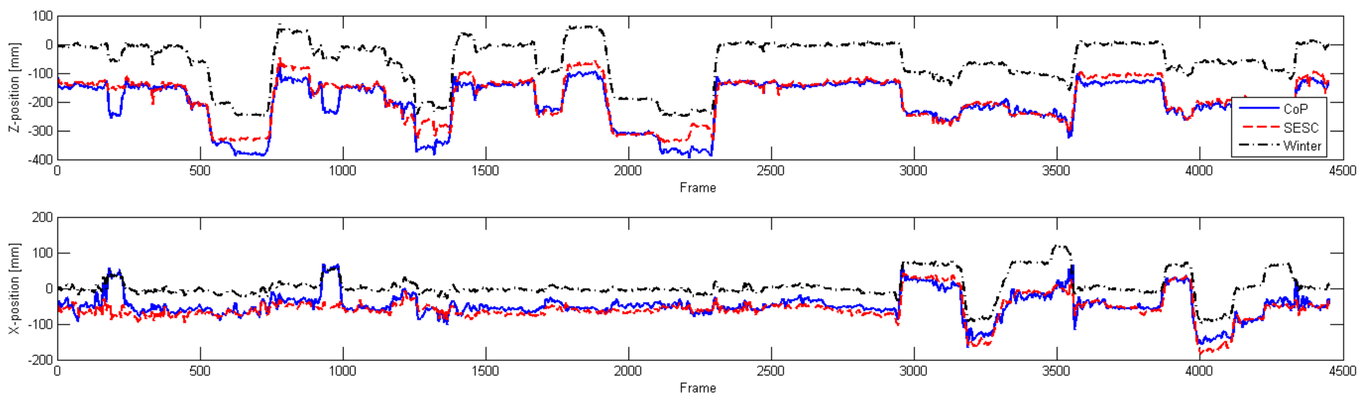

FIGURE 3: Cross-validation results for the CoM ground projection. CoM was estimated with the previosly identified SESC and antropometric data and compared to measured CoP.

FIGURE 4: Subject's CoM position is estimated by the SESC (green).

FIGURE 5: There is no need for CoP information to estimate CoM.

Objective

We develop a portable tool for **estimation and visualization of center of mass** (CoM). With it, it's possible to give real-time visual feedback to the user. This tool may be used away from the laboratory and its applications can include in-home rehabilitation and balance training.
To increase portability and reduce cost, a Kinect is used for tracking subject motion. *A Wii board serves as force plate an is used only during identification phase.*

SESC

To find the CoM position we make use of the use the statically equivalent serial chain (SESC) whose end effector is located at the subject's center of mass. The orientation of each SESC link corresponds to that of the subject's limbs. The length of each link corresponds to a function of both the limbs' weight and size. For the skeleton model used these lengths are constants.

Visualization

All data is expressed in the Kinect frame. CoM can be displayed from either live or recorded data. Interaction with the video is possible using the keyboard or mouse.
Kinect video is analysed and rendered in 3D using the *OpenNI-Primesense* middleware and *GLUT*. The *OpenCV* library is used to the necessary matrix operations.

Experiment & Results

Two subjects were asked to perform and hold static poses while standing on top of the Wii board. For each subject, around 42 poses were used to calibrate a 27 parameter SESC model. The obtained model was optimal in the least squares sense for the identification set. An additional recording was made, in order to perform a cross-validation test and evaluate the performance of the model.

Ongoing work

- Validation with more subjects.
- Model definition based on intended use.
- Compare to other systems.