DIGITAL HUMAN MODELLING AND ANIMATION FOR THE VIRTUAL FASHION SHOW

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Abstract

Inside this paper is presented technology of processing SABALab, a virtual humanoid models with computer 3D biomechanic and anthropometric analysis that are surveyed on the cloned models. It is done the 3D body scanning of the real models with their computer supported 3D statistic and dynamic Body shape analysis, so the necessary computer simulation and visualization of the virtually generated environments and constructed animated simulating humanoid characteristic models could be obtained. Computerized model clones are processed for the need of the Croatian fashion industry and are dressed in the virtual clothes and footwear manufactured by Croatian designers. In this way the developed animated dressed mannequins provide fast manufacturing of the virtual prototyping clothes and footwear inside the process of production. Also, it develops the share of the business subjects in the global market within of Live Catalog, Online Web applications, virtual business interactions and digital presentations.

Keywords: anthropometric, biomechanic, digital human, computer environment, virtual fashion show

1. INTRODUCTION

In this paper is shown a statistic anthropometric analysis of the Croatian population and on a basis of the similarities is compared to the anthropometric measures that Kramer has used for the German population where measurements were conducted on 15000 male and female subjects. Also, it is shown a harmonic circle for a so-called synthetic making of an individual anthropometric measurements of the randomly chosen subjects of the both gender.

In the last few years computer generated environment systems with an animated virtual humanoid models, concerning of the fast development of a computer technology, are in a lots of ways used with different scientific,visual, educational or marketing processes of visualization, and in the film industry, especially in manufacturing of rather complicated Virtual Fashion Shows they represent technologically developed and modern models for the textile industry.

In the last ten years Project Cyber Fashion Group (CFG) by S.Baksa, and now SABALab are trying to integrate 3D scanning, digital body measurement, CAD, CAM, Virtual Stores, virtual prototyping and E-Commerce Technologies in the Croatian Fashion Industry [1].

2. GARMENT SIZING AND ANTHROPOMETRIC MEASUREMENTS

In the conditions of manufacturing of the made-to-measure apparel, systems of the garment sizing is of a great importance. To satisfy a greater number of customers it is necessary to develop such a system that will allow a better choice of garment size.

Today's different systems of garment sizing and labeling those sizes are representing a great confusion and are causing discomfort to the manufactures, trade and customers, especially in the internationally conducted business. Therefore, on a basis of the proposed new European systems, in a near future in the world and Europe will exist a unique system of sizing as well as system of marking those sizes.

To determine an optimal rational system of garment sizing, it is necessary to look at the proportions of the human body, anthropometric measurements, as well as the European and international systems of garment sizing and marking those sizes.

Within a clothing engineering, anthropometric measurements are used in the field of a garment construction. For the garment construction are necessary characteristic body measures as well as their proportional relations. These measures can be determined by anthropometric measurement of a representative pattern of a certain population. The results of the anthropometric measurements of the sufficiently extensive population can be used to determine a national system of garment sizing.

All body measures that are determined and showed on the anthropometric surveys are not always unnecessary in the process of manufacturing of every type.

There are three groups of constructional anthropometric bodies: horizontal, vertical and other measures. Anthropometric garment measures include 55 anthropometric measures; 26 horizontal, 27 vertical and two other measures.

Figure 1 shows constructionally anthropom(etric measurements of the bust girth that belong to the group of the horizontal anthropometric measures.

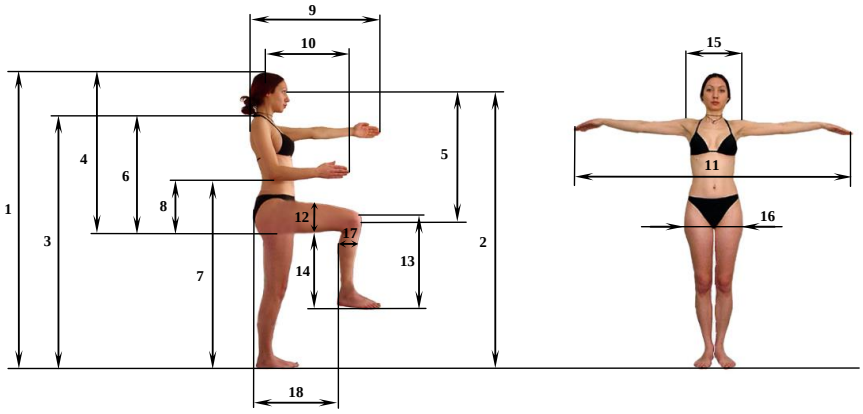

Figure 1: Anthropometric measurements of the constructionally measured.

In a Table 1 you can see Kroemer's values of anthropometric measures for women, and next to them are the written results of the computer measurements of anthropometric measures on the Croatian population.

Table 1: Display of the values of the anthropometric measures for women.

MARKING AND NAME OF ANTHROPOMETRIC MEASURE		ANTHROPOMETRIC MEASURES (CM)		
		Kroemer	**Variations**	**Our data**
1	Standing tallness	161	150 – 172	165
2	Eyesight height (standing)	150	138 – 162	154
3	Shoulder height (standing)	131	120 – 142	134
4	Sitting height	85	79 – 91	86
5	Eyesight height (sitting)	74	68 – 80	73
6	Shoulder height (sitting)	54	49 – 59	54
7	Elbow distance (floor)	97	89 – 105	99
8	Elbow height (sitting)	24	20 – 28	23
9	Arm length	70	63 – 77	71
10	Length of the arm	42	38 – 46	43
11	Arm reaching range	155	139 – 171	163
12	Distance from knee to back	57	52 – 62	58
13	Knee height (standing)	50	46 – 54	49
14	Sitting height (to the floor)	43	40 – 46	44
15	Shoulder width	41	37 – 45	40
16	Hip width	37	33 – 41	34
17	Hip height (sitting)	14	12 – 17	13
18	Hip length (sitting)	46	43 - 50	47

3. VIRTUAL CHARACTER MODELS

Based on fashion photographs of a real SABALab fashion model, P.Antičević, and using conventional CG techniques, digital virtual character model is designed and constructed. Fig. 2 shows the phases of constructing the segment of the head of the virtual model. The whole of the personal 3D body form is done employing the same principle, figure 3.

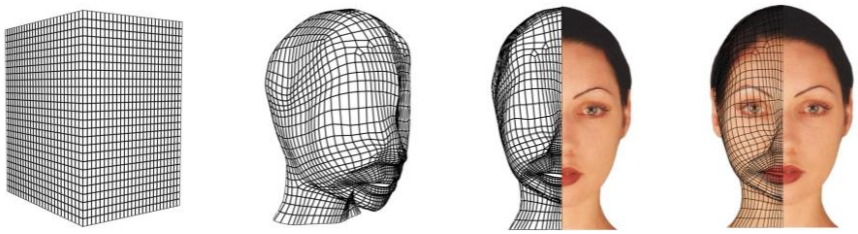

Figure 2: Phases in hand modeling of a virtual 3D character's head

A contactless coordinate-measuring device, so called digital 3D scanner, can be used instead of conventional tape measure and the equipment for defining human body dimensions and volumes. The result of stereoscopic measurements of the body is a 3D cloud of coordinate points, which represent the body measured. These measurements enable easy construction of a digital virtual model. The measuring system employed enhances accuracy and efficiency, compared to conventional methods. The results obtained are not just the object measurements, but also its forms and volumes [5].

Considering fast development of 3D registration of the subjects with the help of the fast, optical three-dimensional body scanner, SABALab has also developed and offered a three-dimensional digital body scanning with 3D Body Measurement system ″*Body*SABA″, figure 4. Body Capture System is in an initial phase of its development. However, as can be seen at the digital 3D presentation in Figure 6, its applicability even in its present form is quite obvious for contemporary techniques of digital scanning. The system can be used for garment and footwear design, garment and footwear industry, car industry, development of video games, construction of virtual bodies, creation of internet-oriented characters, doing business on the Internet, anthropologic research, ergonomic studies, healthcare applications, sports analyses etc.

Figure 3: Hand modeling **v**irtual 3D body form in Wireframe

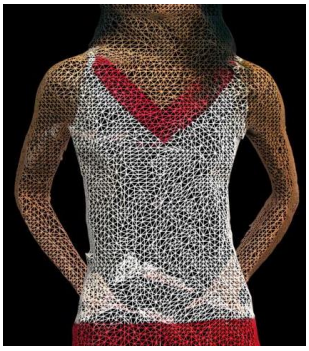

Figure 4: Scanning with digital Body Capture System ″*Body*SABA 0.3.″ and digital 3D presentation of the object scanned in Wireframe

″*Body*SABA″ scanner works on a Principe of a computer selection of the body contours, based on a photometric methods, and on a base of these informations it builds a virtual model. The original photos are then used for realistic mapped texturing of the 3D objects. The mentioned method of the computer section of the body contours provides low-cost and high quality alternative for the creation of 3D personalized virtual figure. Scanning is fast, simple, safe and more than anything, an interesting experience when compared to todays processes of taking body measures and which is more important it is more accurate than the standard methods.

4. VIRTUAL BIOMECHANICAL MODELS

Precise knowledge of dimensions and parameters of the human body, and processing of the biomechanical model that will, as best as possible, simulate the real condition, is the most important task when analyzing movements. Basic values that are necessary when describing movements are; anthropometric measures, that is a length of the segments of the human body, segmental mass and their distribution by chosen coordinating system and by dynamical moments of a certain body segment, as well as the whole body. Several experts in biomechanics experimentallz studied the pertinence of the virtual biomechanical models in the inverted kinematics to express the postural control of human [10].

To determine a special position of the characteristic points of the subjects body and considering the making of the technical wire skeleton model of the subject, it is used a motion capture system *Vato*SABA 1.4. Figure 5 shows capturing of *Vato*SABA 1.4. with mocap system and made wire biomechanical model of the subject in the neutral position.

Figure 5: *Vato*SABA 1.4. with mocap system and
wire biomechanic technical skeleton.

Biomechanic model needs to capture the largest number possible of movement freedom degrees and with its characteristic simulate as best as possible the real condition. For that the most appropriate model is the model of kinematic chain of spine with chest and 5 open kinematic chains: head,arms and legs.

The mobility of the system can be defined by number of free movement degrees, and that is important considering the eventual possible reduction to a reasonable measure to work-out different research approaches. Another useful reason of knowing the degree number of free movement is a possibility of definition of tehmathematic synergy, some parts of the human organism, both for the theoretic and practical reasons [4].

Structural scheme of a human skeleton has a significant number of free movements degrees. Considering that a human body consists of: 95 joints with one degree of free movement, 80 joints with two degrees of free movement and 75 joints with three degrees of free movement and which sums up 250 degrees of free movement; all the complexity of kinematic and dynamic studying of the human skeleton is understandable. Some authors mentioned degree numbers of free movements of the normal skeleton, from 240 to 300.

Based on an inner kinematic model of the human body, an outer kinematic model that shows the muscle structure of body is formed, where inner kinematic model serves as basis for that construction. Computably, even the most complicated movements of 3D model consist of different basic movements in some of its parts, and in some joints same as with the locomotory system of a men [7].

Construction procedure of biomechanic model is shown in Figure 6.

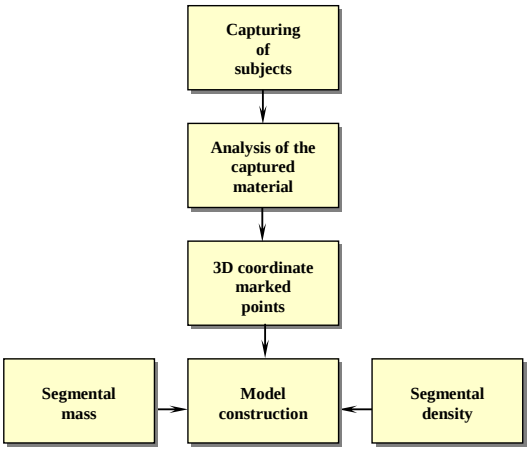

Figure 6: Procedure of processing a biomechanic model

When modeling virtual biomechanical model, the main goal is to find the best possible compatibility of segment mass center positions and of the whole body in the real condition. Alike mathematical models were developed by Hanavan, Hatze, Passerello and Huston, Yendonn and Muftić [8].

5. VIRTUAL 3D HUMAN MODELS

To give successfully a virtual 3D subject, with animation methods and procedures, an illusion of life and personal character it is necessary that with a dose of artistic intuition for characteristic animation, one scientific and with comprehension studies the biomechanic motions of resting and movement of a man, as well as the movements of all living beings [5]. Problems of mechanic movements of living beings are very complicated, especially movements of humans, and usually while classifying biomechanic patterns, in their analysis and synthesis of movements, when it is necessary to determine, at the same time, the mobility and directing of the studied system or group of systems.

Traditional approach to animation with 3D character is to use animation as the key shots. This approach gives a very good qualitative animation results, but animation procedures are very long which results with the high cost end production. Modernized and very popular animation approach is base on a employment of ″Motion Capture″ system. This system detects complete motions and movements of the real human subject and then they digitalized the real motions in the corresponding behaviors of the virtual characters. Motion capture systems must translate the real captured movement of the real subject to the virtual character in the virtual environment. All motion capture systems have the ability to store captured data for later analysis and processing [9].

Figure 7 shows an insert of computer animation of a virtual modeling character based on the real movements of the real human model.

Figure 7: Frame of a 3D Modeling with Catwalk presentations
of First Croatian Virtual Fashion Show.

6. CONCLUSIONS

Based on a mentioned procedures of processing the virtually human models, and with their animation it is possible to digitally make a visually realistic fashion show.

Digitally generated humanoid models, no matter if they were made by the traditional handmade methods of modeling or by using a modern 3D no contact body scanners, show realistically body shape of every surveyed subject. Further, it is possible, with their virtual body animation to dynamic follow or analyze the movements made by the real subjects or digitally generated movements or motions that belonged to a completely different person.

Computer simulation of a human body provides the adjustment of the consumer's real body measures on simulating humanoid model. Also, the possibility of virtual dressing of the prototype garment on an animated humanoid model that has the same body characteristics as the customer provides the realistic display of suiting's of a future garment.

Computably simulated humanoid models can be adjusted in a popular Virtual Cloth and Web Garments Catalogs.

Realistic derivative computer models find their place inside the interactive and highly realistic virtual shopping environment where visitors of the Internet pages, or potential customers of virtual-try-on visualization techniques can choose between many garment models and they have the opportunity to simulate on line the chosen clothes on virtually animated models. The concept that is developed by many European and world countries of made to measure garment manufacturing and retail shopping via Internet, virtually home shopping with virtual fitting room can be done.