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Influence of 3D CAD in Apparel Industry as a Prominent Tool for Checking Garment Fitting

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ABSTRACT: Digital technology acts as a driving force of modern civilization, have led to significant changes in everyday life, made possible by the widespread use of computers. Based on the utilization of 3D CAD simulation, the product development in the clothing industry becomes faster and faster. The integration of 3D CAD systems for garment design leads to higher accurate cloth fitting which in previously took a long time to match the actual measurement demanded by the buyer using real time dummy. The purpose of this paper is to investigate the use of 3D CAD with computer simulation to facilitate better body fitting during construction without using physical dummy by converting 2D CAD into virtual 3D prototype using CAD software. Our aim is to conceptualize a system that allows the designer to develop a product precisely as per buyer requirement to ensure the best quality service with the least span of time.

KEYWORDS: Apparel, CAD, 3D, Garment, Fitting, Simulation, measurement.

1 INTRODUCTION

The application of computerized technologies in the manufacturing sector is widely practiced in every aspect now a day. However, the use of modern tools seems to be less in ready-made garment sector than other sectors. It is mainly due to the requirement of high capital investments well as skilled labor. The application of 3D CAD system has already emerged in few apparel industries and likely to be expanded gradually in the upcoming days as it makes easy for designers, pattern makers and manufacturer to present style decisions, test the fit of the garment which allows a designer to perform his task more accurately with stunning visual appearance in less time. Pattern making skill and creativity are the essential requirement for designing highly complicated garments [1]. In apparel industry, the basic patterns are developed initially and to develop a pattern, the designing of each and every pattern are necessary before going bulk production that make up the dimensional typology model for a given proportion and drape. The widespread use of CAD systems in textile industry to develop pattern along with database with the aid of 3D scanning technology of the human body when the exact body measurement is not found on 3D CAD software, used to extend virtual modeling of the dimensional correspondence body-dress in the work of finalizing the 2D patterns after the concrete body dimensions [2]. Cain et al. said that fit is directly to the anatomy of the human body and most of the fit problems are created by the bulges of the human body whereas Chamber et al. and Wiley said that clothing that fits well, conforms to the human body and has adequate ease of movement, has no wrinkles and has been cut and manipulated in such a way that it appears to be the part of the wearer [3].The accuracy of the fit when the garment in worn on the body is the key dimension to ensure the purchase of clothes through 3D virtual prototyping. Therefore, the importance of three-dimensional technologies for generation virtual dummy or model that reflect the exact body measurement and body shape of individuals as well as technologies for trying virtual garment [4]. One of the major challenges for the apparel industry is ensuring that the fit of the garment is as close as possible to its target customer [5]. Every human body is created symmetrically although there are some identical properties in every human body. Due to the difference in shoulder angles or oblique pelvis position, every garment design must have to be subjected to fitting first. The main preference of using virtual platform is the ability of creating a mirror image of a person completely and the average it with the unsymmetrical original [6]. Any discomfort or prickliness in terms of Physical comfort or mental perception towards a manufacturing industry, drape and appearance all play a part in the consumer's perceived satisfaction of fit. It is difficult for the designers to match the exact fitting using manual tools. Moreover,

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the preference of consumer in terms of fitting may differ from consumer to consumer in terms of the demand of either a loose-fitting garment or a slim-fitting garment. Now-a-days, most CAD software are offering both 2D and 3D design facilities. As a result, the designer or the manufacturer of any garment can instantly check the fitting and look of the garments and fabrics during product development in the virtual platform and getting approval from the buyer easily. In general, clothing CAD systems usually involve one or more of five key processes which are: 2D pattern design, pattern prepositioning, e virtual sewing process (also called virtual try-on), drape simulation and design modification in 2D or 3D [7]. Virtual prototyping is a user friendly technique for designing and developing new and critical garment that involves application of computer aided design intended for garments development and virtual prototyping of them [8]. A number of virtual 3D CAD software, such as CLO 3D, Lectra 3D Prototype, Optitex and V-Stitcher 3D, Tukatech are available on the market for simulation of garment to evaluate the fitting fit. The software, normally include four main modules: 1) a 3D parametric mannequin module, 2) a fabric properties module, and 3) a virtual pattern sewing module [9]. In this paper, we propose 3D CAD that allows designer or manufacturer to place the clothing patterns to the proper positions of human models by using tools of 3D CAD software so that the patterns are placed perfectly to get the best simulations and ensure that the fit of the garment is as close as the body. We adopt a physical based modeling of clothing patterns that can stretch and bend with the movement of the body as well as showing the deviation in measurement from original one due to seaming process to ensure proper fitting of the end product. It provides precise pre-positioning that allows seaming of any place of the garment and indicates if any correction is required for proper fitting. Moreover, the complex designs which takes huge time using manual method, can be performed very easily using computerized technology. In some instances, the 3D coordinates of an actual garment are measured according to the lattice points of a 2D cloth and the pattern mapping lies on a true 3D surface is executed [10]. We propose a clear concept that 3D CAD will make it easier to check the fitting of the garments through its virtual dummy as so to complete the task with a very marginal deviation. Moreover, if any correction is required, designer can correct the design easily with the availability of 3D CAD tools.

2 EXPERIMENTAL

2.1 MATERIALS

As mentioned above, we needed specific measurements to develop the garment both in 3D CAD and in 2D CAD. We took the measurements needed to develop a men's tops item. The measurements were used to prepare the block pattern in 2D CAD and then the patterns were sewn and curved virtually to get a three-dimensional effect by using 3D CAD system. Also, to get better results, we got two garments prepared by the sample section from a renowned industry. The samples helped us to make the comparison between the virtual and real appearance outcomes. "MV2_Thomas" mannequin having same measurement was used as the real representative. We used "Lectra" and "CLO" software both to get better results, i.e. better resolutions.

2.2 METHODOLOGY

In this study, we have collected quantitative data like- the different measurements of the virtual mannequin and the real mannequin having exact measurement. A men's tops item measurement was used here. After collecting data, we compared the two sets of data to find out the similarities between virtual 3D and predetermined measurements of critical parts. We can divide the whole process into two halves- the two-dimensional part and the three-dimensional part. Firstly, the basic block patterns of the item are developed in the two-dimensional CAD system and then the stitching and virtual appearance via a mannequin is developed in the three-dimensional CAD system. The fitting will be checked to find out our results of using 3D CAD system and finally we can compare the real-life measurement with the 3D measurement.

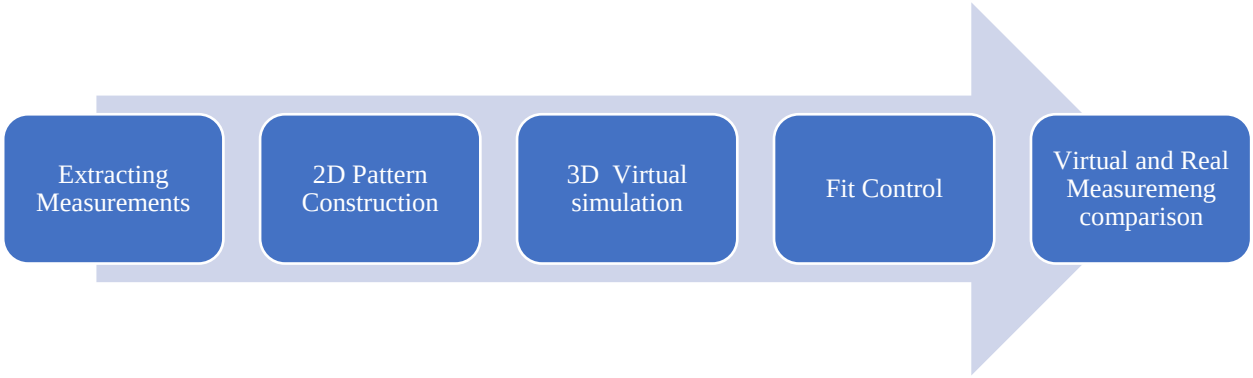

Fig. 1. Overall Process sequence of the study

2.2.1 2D Pattern Making

In professional garments manufacturing field, designers or manufacturers develop their patterns by using 2D CAD. We get our patterns developed by 2D Lectra Modaris software. At first, we studied our measurement chart to identify the critical measurement points to draw the 2D pattern. Then with the help of 2D CAD software, six patterns pieces were developed- a front part of the main body, a back part of the main body, neck rib and two sleeves as well as a sleeve hem. After completion of this patterns, the pieces need to be given input on CLO software for further processes.

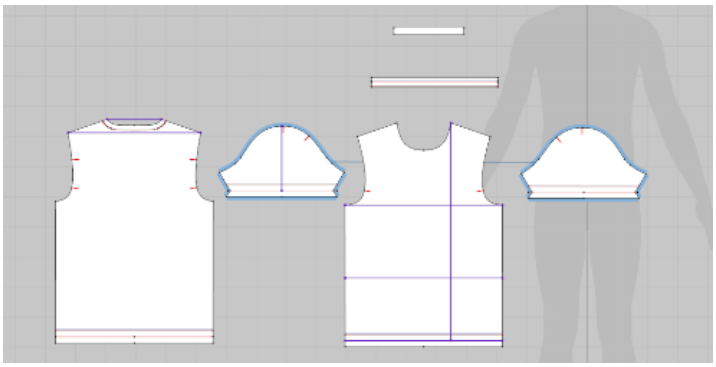

Fig. 2. 2D pattern pieces on CLO software

2.2.2 Pattern Placement And Seaming Process

The 2D patterns are displayed on a grid in the simulation software, representing the cloth surface. The planar patterns are placed around the virtual mannequin. A manual placement is implemented with an automatic function to bring the pattern to the closest position to the body surface. Considering that the seams will gather the edges of each pattern together, an approximate initial positioning is necessary. The space between two seam lines should be as small as possible in order to accelerate the process and to obtain a precise final garment. Through the collision detection, small initial problems can be automatically solved. It is preferable that the patterns do not interpenetrate itself and the body initially. After the placement of the patterns around the virtual mannequin, the seaming can be executed.

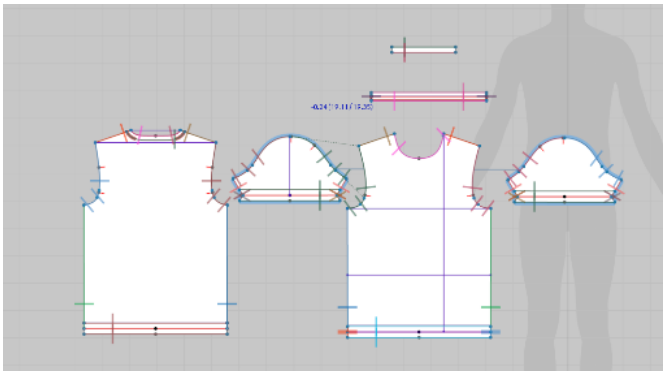

Fig. 3. Seaming process to make a complete garment

2.2.3 Changing Size And Checking Appearance

What would have happened if the measurements of the garments were changed? To check the fitting appearance of an oversized garment, the patterns were graded, means a range of XXS to XXL was prepared. So, after seaming the 'L' size patterns, once again, we took 'S' size patterns and again the appearance was checked by the 3D CLO software system. There is no need to develop more than one garment in this process. Using various virtual dummy, the fitting of various sizes can be done easily on CAD software. If the existing dummy shape or measurement is not matched with the buyer measurement, then the selected dummy has to be scanned by 3D Scanning process and the process of changing size to check the appearance continues.

Fig. 4. 3D CAD simulation on CLO

3 Result and Discussion

3.1 Color Indicator

Modern 3D CAD systems offer garments fitting check via color indicator scale. Different color shows tightness or looseness of the garment by collision detection and friction to the body. Here, Red color indicates high tightness, Yellow stands for a lower portion, White indicates exact fitting of the part/ portion, Sky-Blue and Blue indicate less looseness and high looseness successively. So, here we find an easy way to identify either the fit is perfect or not. Moreover, the software aids in the correction process of the deviation in measurement by its unique color indicator properties, which will aid an accurate and effective fitting of the end product. We found this property in Lectra 3D software.

Fig. 5. Observed special feature for checking tightness or looseness in Lectra software

3.2 MEASUREMENTS IN 2D AND 3D

Some critical points of the patterns were considered as reference points to check the deviation of three-dimensional measurements from two dimensional measurements. The result we got is shown here:

Table 1. Comparison of measurements in 2D and 3D with respect to original measurement

Critical Measurement Point	Original Measurement (cm)	Measurement found in 2D (cm)	Measurement found in 3D (cm)
Length	72	72.07	73.21
Chest	52.5	52.30	52.79
Waist	52	52.25	52.09
Bottom	52	52.19	52.09
Across Shoulder	44	44.01	45.48
Neck to neck	18	18	15.67
Sleeve	21.5	21.41	22.20

3.3 VARIATION IN MEASUREMENT ON 3D VIRTUAL PRODUCT

Causes of variation in measurements: It is observed that a very little variation occurred in both 2D and 3D CAD methods which are negligible as the variation will be significant if manual method is used. Moreover, a slight variation is also noticed between 2D and 3D CAD methods which are due to the seam line used in seaming of various pattern parts during completing a total garment as well as the amount of lycra (almost 5%) present in the fabric.

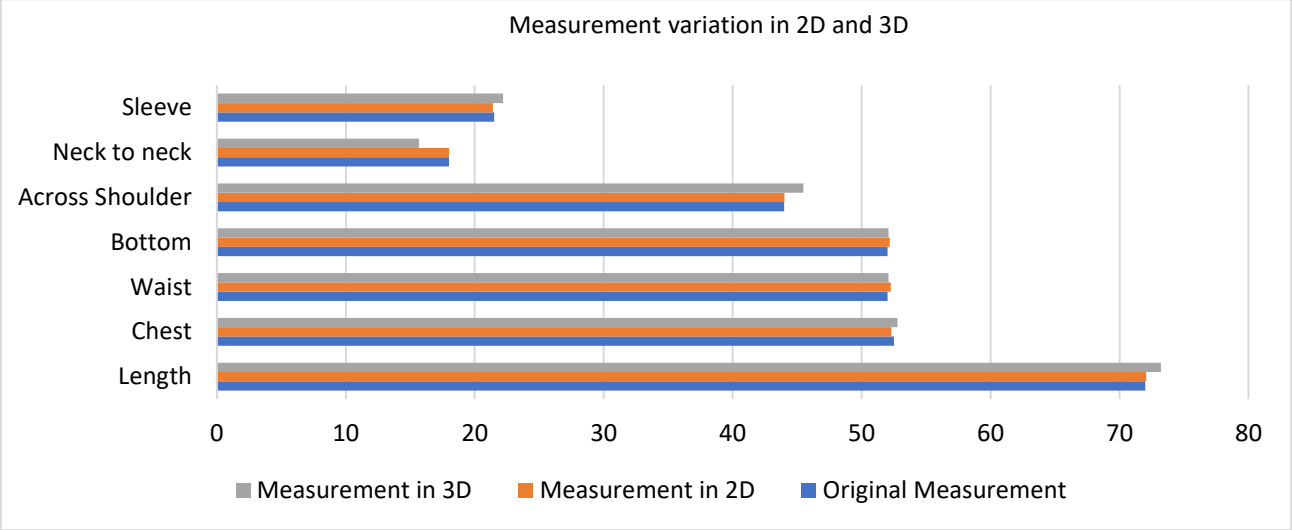

Fig. 6. Variation of Measurement in CAD platform from the original one

Causes of variation in measurements: It is observed that a very little variation occurred in both 2D and 3D CAD methods which are negligible as the variation will be significant if manual method is used. Moreover, a slight variation is also noticed between 2D and 3D CAD methods which are due to the seam line used in seaming of various pattern parts during completing a total garment as well as the amount of Lycra (almost 5%) present in the fabric.

4 CONCLUSION

As our study described already, traditional two-dimensional designing and fitting check process was a time and money killer process. A designer had to develop and modify the samples again and again in order to pass the fitting requirements barriers of the buyer, which demanded money and labor. It also affected the product lead time. We took a specific garment for virtual fitting system, checked it and also found the differences and deviations. The result was satisfactory and would be better more if some other steps could be taken as well as using more experienced worker in CAD section. We hope, all export-oriented garments manufacturing industries will apply this 3D CAD simulation to develop and check sample garments' fitting and can save their effort, money and time. We hope that the entrepreneurs will invest for the installation of 3D CAD software to ensure proper fitting of the end product as per buyer demand not only to satisfy the buyer and gaining buyer morale but also to cope with the ever growing automation in the other industries to ensure the position of the textile sector as the prominent one.

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