Research and Analysis of Virtual Clothing Design Based on Artificial Intelligence Technology

Yuxiao Tu *[1], Luru Li [2 a], Zheng Li [2 b]

[*] Corresponding author: tuyx15797202350@163.com

[a] m18075925618@163.com, [b] sudalizheng@sina.com

[1]College of Textile and Clothing Engineering, Soochow University, Suzhou Jiangsu 215006, China,

[2]School of art, Soochow University, Suzhou, Jiangsu, 2150062, China

Abstract: The in-depth research in computer graphics and the rapid development of digital technology have driven the structural adjustment and technological upgrading of China's garment industry, making the application of virtual technology gradually an important feature of the development of modern garment enterprises. Apparel virtual technology mainly consists of human modelling, garment modelling, virtual fitting and virtual presentation. Apparel virtual technology aims to provide designers with a convenient virtual interaction platform to reasonably simplify the design process, thereby reducing design costs and improving design efficiency. The popularity of apparel virtual technology can better protect the patent rights of products and reduce enterprise risks. It is groundbreaking and cross-generational in terms of garment customisation and digital 3D display, and thus has a broad application prospect. Benwen delves into the various possibilities of garment design, offering better ways to design contrasts and design approaches for the development of garment design, as well as more optimal design approaches and styles.

Keywords: Artificial intelligence; Virtual clothing; Modelling of clothing; Human-computer interaction

1 INTRODUCTION

Clothing virtual technology began in the 1980s. In the past, designers mainly used two-dimensional garment renderings to convey their ideas about the overall garment, which were more a reflection of the designer's design intentions [1]. The pattern maker then uses the information from the rendering to make the pattern and sew the garment, and finally confirms that the garment fits well and that the design concept is correct before industrial production. During this process, the garment design undergoes two different dimensional transformations, first from 3D to 2D and then from 2D to 3D [2]. The first dimensional transformation is a two-dimensional image of a three-dimensional garment in the designer's retina and mind, while the second transformation is the process of turning a two-dimensional drawing into a three-dimensional garment. Therefore, the creation of 3D virtual technology can help designers to think about the structure of the garment and to test and analyse the virtual garment, thus shortening the production time of garment design and development and reducing the risk of the company [3].

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2 VIRTUAL AND MODULAR DESIGN OF CLOTHING

2.1 Apparel virtual technology applications

The specific operations of the virtual fitting include: (1) Collating and placing the sample. Importing a 2D garment CAD sample, organising it according to the relevant information shown on the plate according to the part, and placing the plate reasonably according to the key points of the 3D model; (2) virtual sewing of the sample. Virtual sewing of side seams, shoulder seams, etc. using sewing tools in the same way as actual sewing, paying attention to the order of sewing backwards and forwards; (3) Simulation and adjustment. The execution of the simulation command makes the 3D virtual window present the virtual garment effect, the designer will try on the effect to determine whether it meets the design requirements, if not, the 2D version of the window will be adjusted, and the 3D virtual window will link itself to achieve simultaneous modification [4]. At the same time the designer can directly adjust the decorative lines and dividing lines of the two-dimensional plates to achieve rapid style development.

The implementation of the virtual fitting function requires a number of key technologies to support it, and the corresponding modules need to be set up to meet the needs of the client and the server [5]. The client needs a size adjustment module and a simulation module, while the server needs to create a database of body types, clothing and backgrounds. Therefore, according to the category of the virtual fitting system, it is necessary to use the corresponding way to implement, the mainstream implementation methods are mainly Android platform virtual fitting system, Kinect virtual fitting system, sketch virtual fitting system and so on [6].As show in figure 1.

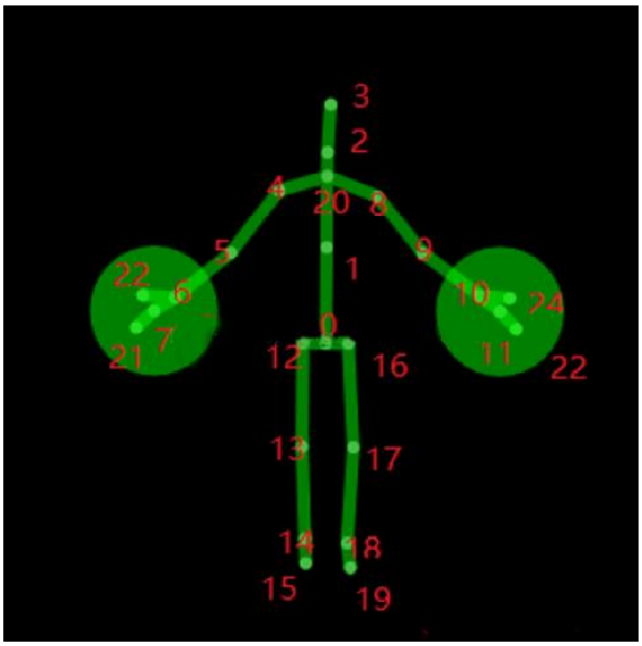

Figure 1. Key points of the Kinect skeletal model

2.2 Apparel Virtual Design System

(1) Style 3D

Style 3D is an apparel 3D digital service platform developed by Lingdi Digital Technology Limited, which is dedicated to promoting the digital integration of the whole ecology of apparel design, production and sales, and integrating the development of digital and intelligent all-in-one solutions for the fashion industry. The system allows for the unified and efficient management of designers' planning materials, and establishes a multi-dimensional classification and filtering scheme that can effectively improve the efficiency of finding design resources [7]. At the same time, resources such as fabrics, accessories, packaging and printing are entered or scanned into the system in digital form to facilitate the centralised management of design resource information by enterprises. It is possible to synchronise 2D and 3D data changes during the design process and present the modification effect in real time, thus effectively improving communication efficiency in design development. The system also has a fabric simulation engine and uses the mass-spring model and the finite element continuum model for numerical solution of the model, which can simulate the texture characteristics and complex details of the fabric in detail and better express the elasticity, plasticity and wrinkle resistance of the virtual garment. With Style 3D you can save 30% in labour costs and achieve a 3-day turnaround time for a single product [8].

(2) V-Stitcher

V-Stitcher is a 3D virtual design software for the apparel vertical developed by the Israeli company Browzwear International and is the leading virtual prototyping tool for the apparel industry [9]. It is based on the integration of traditional design techniques and the use of CAD/CAM apparel industry standards. By combining body, fabric and pattern, it calculates and simulates realistic fitting effects to better help designers communicate their design concepts [10]. With V-Stitcher it is also possible to design 3D garments online remotely. The fabric test kit FTK from Browzwear also enables accurate measurement of fabric flexural and tensile properties, reducing V-Stitcher's product design cycle and saving costs.

(3) System variance analysis

Style 3D and V-Stitcher contrast, in the fabric detailing, V-Stitcher in order to get more realistic fabric virtual effect, independent research and development of the fabric analyzer, to measure the fabric strong extension, bending and shear characteristics and test analysis results, while the analysis of the fabric thickness, elasticity, curvature and other properties can be directly into the software, so that the simulation of the fabric texture more realistic, as shown in Figure 2 below. As for Style 3D, a new type of virtual software developed independently in China, there is still a lot of upside in its texture detailing, and companies are constantly optimising the core algorithms such as fabric physical models, garment human collision detection and fabric rendering. In terms of business processes, V-Stitcher enables real-time 3D remote online garment design, which apparel companies can use to carry out their garment customisation business online. Style 3D has its own design platform, uploading the designed virtual garment model with a single click and communicating the design details with the customer on the platform, outputting the confirmed model process information directly to the production, effectively shortening the product design development time.

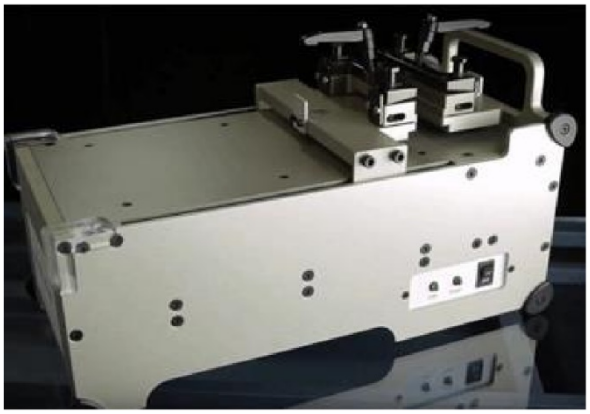

Figure 2. Fabric analyser

2.3 Modular product design

(1) Modules and modularity

Unlike traditional design methods, modular design is not from design conception to performance, but the design content is decomposed and extracted before integrating the design content, specifically in: modular design is a standardised design, while traditional design is a targeted specific design; the process of modular design is top-down, while traditional design is bottom-up; modular design is a combined design, while traditional design is a holistic design; the end product of modular design is a product or module, while the product of traditional design is just a product. The advantage of modular design over traditional garment design is not only that it solves the contradiction between specialisation and variety in garment production, but also that it provides a platform for collaborative design between customer and designer. It allows customers to customise personalised garments and also enables companies to achieve a production model based on sales, thus reducing inventory pressure.

(2) Modular design process

The modular design process can be traced back to customer requirements management down to the formation of the corresponding product modules. Accurate analysis and processing of customer requirements is the key to determining whether the modules are justified and whether the company can achieve rapid product delivery. The process of forming the corresponding product families on the basis of the conclusions of the customer requirements analysis, followed by the modularisation of the products, is a process that needs to fully comply with the principles and guidelines of modularisation. The final division of the completed component modules to establish the corresponding module resource library, for the subsequent product configuration design based on customer demand, that is, the process of achieving modular products to provide a large number of design resources. The specific modular design process is shown in Figure 3.

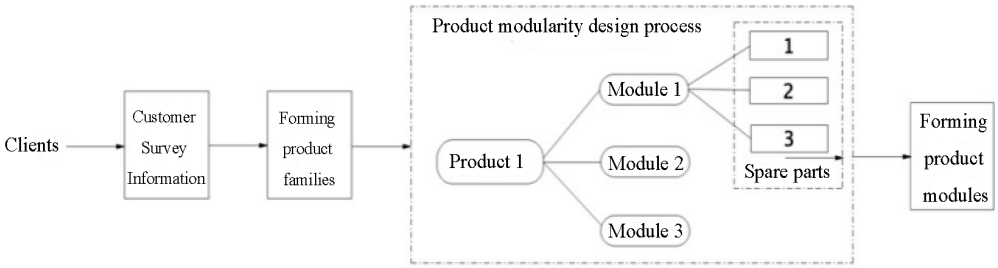

Figure 3. Product modularity design process

A series of information surveys and analyses of the target customer result in the formation of a product family. Once a product family has been formed, the apparel company will have identified the product categories that require modular design.

(3) Apparel modular design applications

Modular design is already being used in fashion design, for example, in Bijan's collection, the components of the garment are broken down into individual style modules, which are connected by standardized snap fasteners and zips, so that the wearer can freely disassemble and mix and match the modules. At the same time, each season's pieces have the same interface, allowing consumers to match and connect with each other's products from the previous season, enabling 'redesign'. Taiwanese designer Wei Hung Chen has created a 'modular clothing system' that meets the need for individual pieces to be inserted randomly throughout the collection to create 30 different looks using seven modules. This is shown in Figure 4.

a Bijan's Modular Design Series

b Wei Hung Chen's Modular Design Series

Figure 4. Apparel modular design application

3 ANALYSIS OF WEB-BASED VIRTUAL CLOTHING FITTING SYSTEMS

With the rapid development of computer technology and network technology e-commerce has directly changed the way traditional business activities are conducted, including the way sales are conducted, trade negotiations are conducted and after-sales services are provided. As a two-way communication medium, unlike traditional media such as television, radio, newspapers and billboards, which can only transmit information in one direction, the Internet has both a listenable and transmissible Yukon.

3.1 Online fitting models

(1) B/S model

B/S (Browser/Server) mode, is the user login to the system through the WAN, the user work interface is through the WWW browser to try on clothes, through the front-end (Browser) to carry out a series of operations, while other major transactions in the server side to achieve. The user can change the mannequin to match the clothes by simply obtaining the data from the Server.

The biggest benefit of the B/S model is that it is easier to run and maintain, enabling different people, from different locations, with different access to access and manipulate common data. The fitting system is aimed at a wide range of network users, no matter who or where they are, as long as the user's computer itself is installed with a Windows operating system and browser they can access the fitting without taking up too many resources, which greatly simplifies the client computer load.

The relationship between Browser/Server in B/S mode, as shown in Figure 5, is that the user sends a request to the server via the client's Internet browser, the Web server then requests the database server (black arrow), the Web server processes it and returns the obtained result in the form of a page to the client's Internet browser (white arrow).

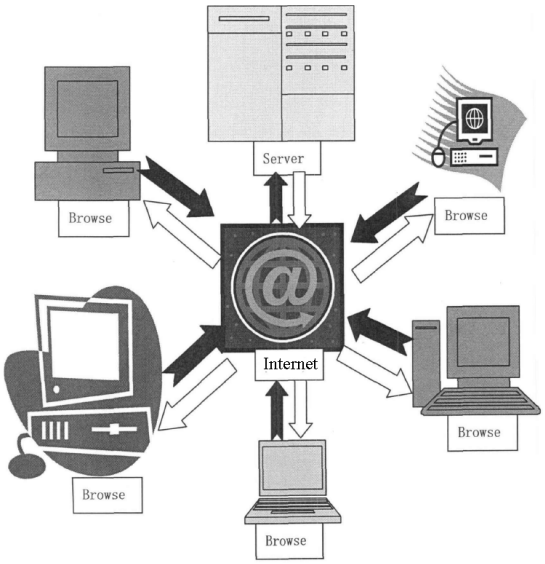

Figure 5. Network structure of the B/S model system

There is also B/S built on a browser, which makes most operations less difficult and very user-friendly, etc. These are some of the benefits of the model, so what are its shortcomings?

(2) C/S mode

The traditional C/S (Client/Server) structure is that of a client application and a database server. The C/S model is a two-tier system: the first tier combines representation and business logic on a client system; the second tier combines a database server over a network. This is shown in Figure 6.

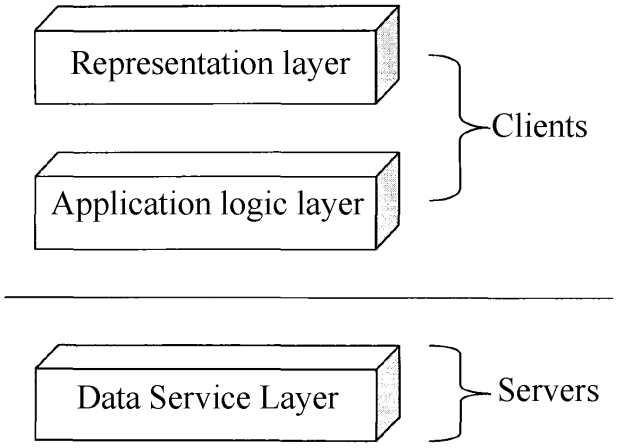

Figure 6. C/S two-tier architecture diagram

With this model, the user has to download a client for the fitting system. The user has a complete application which is then connected directly to the server via the internet. We can develop the client according to the target fitting population, fully satisfying the user's own individual requirements. The operating interface is beautiful and varied, and thanks to the client mode, both the adjustment of the 3D model display and the detailed embodiment of the 3D garment are much more accurate than those displayed in the browser.

4 CONCLUSION

This paper summarises the development of virtual clothing technology and its development, and elaborates on the simulation, fitting and display functions of clothing derived from virtual technology. The four mainstream virtual design software on the market are introduced, and on the basis of a brief comparison of the basic information of the four software, a two-by-two analysis of the system differences is carried out to show more clearly the functions available in each software and their differences.

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