

# The Application of Virtual Reality Technology in Clothing Product Development

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**Abstract:** With the rapid development of modern technology, virtual reality technology is gradually emerging in the clothing industry, which has a profound impact on key aspects such as product design, sample clothing production, production management, and supply chain management. This study delves into the specific application status, efficiency advantages, and complex challenges faced by virtual reality technology in clothing product development. Through system analysis, this article provides a detailed explanation of the technology's implementation of digital clothing design, virtual fitting, and efficient integration of 3D modeling and simulation systems. Meanwhile, this article provides a detailed and in-depth discussion on the application details of virtual reality technology in areas such as sample clothing production, production process management, and supply chain operations. The research results show that virtual reality technology has brought new design and management tools to the clothing industry, effectively improving design efficiency, reducing cost expenditures, enhancing user experience, and driving the entire industry towards more efficient, intelligent, and sustainable development.

**Keywords:** Virtual Reality Technology; Clothing product design; Sample clothing production; Production management.

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## 1. Introduction

In today's digital age, virtual reality technology (VR) has brought revolutionary changes to the clothing industry with its unique and immersive experience and interactive advantages. Clothing product development is an extremely complex and tedious process, which covers multiple aspects such as design, sample clothing production, production management, and supply chain management. The application of VR technology not only greatly enriches the imaginative creative space of designers, but also significantly improves design efficiency and product development accuracy. This article will conduct an in-depth and detailed exploration, focusing on the specific application of VR technology in clothing product development. At the same time, it will analyze how this advanced technology optimizes complex design processes, accelerates sample garment production processes, improves production management efficiency, and enhances supply chain transparency and synergy. Through extensive and systematic research on VR technology in the clothing industry, this article aims to provide theoretical support and practical guidance for the development of the clothing industry, with the hope of promoting the entire industry towards more efficient, intelligent, and sustainable development.

## 2. Application of virtual reality technology in clothing product design

### 2.1. Digital Design and Virtual Fitting Technology

Digital conceptual design is the main driving force for the innovation of the clothing industry, which reshapes traditional design processes through new methods. Of course, virtual reality technology plays a crucial role in this process. High precision 3D scanning and dynamic capture technology enable designers to quickly create or import 3D models of

models, thereby achieving comprehensive digital planning effects. In a virtual environment, designers and consumers can directly observe the wearing effect of clothing with the help of virtual fitting technology, without the need for actual sample production [1]. This significantly shortens the design cycle and greatly reduces costs and time. In addition, this technology can simulate various body types and movements, as well as achieve multi angle display, making it easier for designers to evaluate whether clothing fits and is comfortable, and to anticipate and solve potential pattern problems in the early stages.

### 2.2. Integrated application of 3D modeling and simulation system

3D modeling technology provides a vast and promising creative space for fashion designers, where various exquisite design concepts can be intuitively displayed. Combined with highly simulated simulation systems, designers can accurately measure the various effects of clothing under dynamic conditions, such as whether the fabric has good fluidity and drape characteristics, as well as its actual performance in different contexts and diverse environments. The integration and application of this technology and system can not only significantly improve visual effects, but also greatly enhance the functionality and practicality of the system. In addition, through comprehensive integration, experienced designers can accurately predict the performance of products in actual wear at an early stage, and make necessary adjustments based on this [2]. Therefore, the development and widespread use of this advanced technology have brought more possibilities for rapid prototyping and product iteration, greatly improving the efficiency of the transformation process from preliminary design to final production.

### 2.3. Development and Optimization of Interactive Design Platform

Nowadays, fashion design has entered a new era, thanks to the development process of interactive design platforms.

These advanced platforms integrate virtual reality technology, bringing users an unprecedented new design experience. In a shared virtual space, experienced designers engage in instant creative exchanges with team members, and collaborate efficiently in real-time to explore and research various complex and diverse design solutions, in order to achieve strategic achievements in resource efficient integration. Through an intuitive and easy-to-use user interface, not only professionals but also ordinary people can easily participate in the innovative and complex design process and contribute their unique perspectives and specific needs. The naturalness and fluency of human-computer interaction are further enhanced in platform optimization. Diversified technologies such as gesture recognition and voice control provide designers with intuitive and flexible ways to operate design elements, making it possible to quickly express and modify design intentions. The highly interactive design environment undoubtedly broadens the boundaries of designers' creativity and gives the clothing industry new impetus to open the door to innovative development.

### **3. Application of virtual reality technology in sample clothing production and adjustment**

#### **3.1. Technical Implementation of Virtual Sample Clothing Production Process**

There is an innovative and forward-looking practice in the development of clothing products, which is virtual sample clothing. It utilizes virtual reality technology to quickly transform from design concepts to 3D models into reality. Designers first use the powerful features of 3D modeling software to create virtual prototypes of clothing. Then, through various interactive devices such as VR helmets and controllers, they make deeper adjustments to the proportion, size, and details of the clothing, completing this series of operations. Through careful simulation of different fabric properties and sewing techniques, the entire process is very complex and exquisite. Only in this process can virtual samples display physical characteristics and visual effects that are very close to real samples [3]. Nowadays, this advanced technology not only accelerates the speed of sample garment production, but also reduces the cost increase and resource burden for designers during iterative modifications, greatly improving the efficiency and flexibility of design.

#### **3.2. Analysis and Optimization of Differences between Virtual and Real Clothing Samples**

In the visual presentation of virtual clothing samples, an effect that is close to real clothing samples is reflected. However, in terms of material texture and wearing experience, certain differences cannot be ignored. To narrow this subtle yet decisive gap, it is necessary to conduct in-depth analysis and optimization of virtual samples. By carefully comparing virtual and real samples in various aspects such as pattern, size, and fabric characteristics, designers have the opportunity to discover improvement points and execute necessary adjustments. For designers, they can use highly interactive virtual reality technology to create realistic wearing scenes in a virtual environment to evaluate the comfort and freedom of movement of clothing. The collection of detailed feedback information comes from consumers throughout the entire

virtual try on process, which helps designers make real-time and accurate adjustments to the sample clothing and ensure that the final product meets consumers' specific requirements to the greatest extent possible.

### **3.3. Quick feedback and adjustment of clothing samples based on virtual reality**

Virtual reality technology provides great assistance for rapid feedback and adjustment of clothing styles. In traditional sample clothing production, obtaining feedback information and making modifications usually takes a long time and costs a lot. Now, with cutting-edge virtual reality technology, designers can collect important feedback from wearers on clothing fit, comfort, and visual aesthetics in a virtual environment in real time. These key data are quickly converted into design parameters and are easy to adjust in a timely manner, achieving rapid and efficient optimization and improvement of sample clothing. In addition, virtual reality technology can simulate various body types and movements to help designers anticipate the effects that different user groups may have when wearing, thus making more precise and detailed design adjustments. The series of rapid iterative processes generated by relying on user feedback not only significantly shortens the product development cycle, but also greatly improves the adaptability and user satisfaction of the product in the market [4].

## **4. Application of Virtual Reality Technology in Clothing Production Management**

### **4.1. Virtual collaboration between design and manufacturing processes**

In the vast clothing industry, close coordination between design and manufacturing is crucial for shortening development time and improving efficiency. Virtual reality technology provides a new and efficient way for these two links to collaborate. Through this technology, designers can communicate with manufacturing teams in real-time and smoothly in a shared highly realistic virtual environment, showcase detailed design details, discuss various technical feasibility, and solve problems in the implementation process [5]. This virtual collaboration significantly reduces the number of design modifications and sample production, improves the efficiency of collaboration between departments, and can also simulate the production process, allowing designers to intuitively understand the complexity of the manufacturing process and achieve seamless integration between design and manufacturing.

### **4.2. Application of Virtual Reality Technology in Production Planning and Scheduling**

The smooth and efficient production process of clothing cannot be separated from a crucial link, which is the production planning and scheduling work. By utilizing virtual reality technology, a realistic simulated virtual production environment can be created, which helps to simulate and optimize the entire process. When managers enter such a virtual world that appears to exist in reality, they can pre-set various types and parameters, such as equipment layout, workstation allocation, and material flow paths, making the evaluation of effects under specific planning schemes thorough and in-depth. A detailed and comprehensive visual

analysis of the production process can help identify potential bottlenecks and predict potential production issues, and make necessary and necessary adjustments in a timely and rapid manner. On the other hand, utilizing advanced virtual reality technology to compare different planning schemes and select the optimal and most suitable production plan and scheduling strategy can significantly improve overall production efficiency and reduce all related costs.

### **4.3. Real time monitoring and adjustment of virtual reality technology in clothing production**

Real time monitoring and meticulous and comprehensive adjustments are important means to ensure the stable and smooth operation of the clothing production process. The widespread application of virtual reality technology enables production managers to monitor various states of the production line in real-time within a virtualized control center, and make timely and accurate adjustments to the entire complex and dynamic production process. By utilizing advanced and efficient virtual reality technology, managers can observe various detailed real-time data in every link of the production line, including equipment operation status, work in progress flow, and employee performance. When abnormal situations occur during the production process, managers can quickly locate the source of the problem and simulate different types of solutions in the virtual environment to determine the best adjustment strategy. This real-time monitoring and adjustment mechanism based on virtual reality not only improves the transparency and response speed of the production process, but also enhances the flexibility and adaptability of the production system, ensuring continuous optimization of production efficiency and product quality.

## **5. Integrated application of virtual reality technology in clothing supply chain management**

### **5.1. Application of Virtual Reality Technology in Supply Chain Transparency**

In terms of transparency in the supply chain, the specific application of virtual reality technology has created unprecedented transparency and traceability in the clothing industry. This advanced and high-end technology reveals in detail that every link in the supply chain, from careful procurement of raw materials to distribution of finished products, can be presented in real-time in a virtual environment. Therefore, whether it is brand owners or ordinary consumers, they can deeply understand the entire process of product design to final delivery [6]. Consumers are immersed in virtual reality technology and enter actual production factories that operate in real life. Through seeing and listening, they can understand every detail of the clothing production process. This firsthand experience quickly enhances brand trust. In addition, supply chain transparency also opens up new paths for enterprises to explore potential problems in the production process, and further promotes the optimization and improvement of the response speed and flexibility of the entire complex supply chain system.

### **5.2. Supply Chain Optimization Based on Virtual Reality**

With the support of virtual reality technology, supply chain optimization has become more efficient and innovative. This technology plays a huge role in the clothing industry like a powerful weapon: ensuring product quality is intact, reducing production costs, shortening delivery times, and maintaining high standards. By utilizing virtual reality technology to simulate various types of supply chain scenarios, it becomes easy to examine and evaluate the impact of strategies on cost, time, and resource allocation in a lifelike virtual environment. A detailed and intuitive visualization analysis of the supply chain process can help enterprises successfully identify inefficient and bottleneck prone links. This in-depth understanding makes it possible to optimize the intelligent inventory management system, reducing unnecessary and unnecessary logistics costs, and achieving an overall improvement in the overall efficiency of the supply chain operation. On the other hand, the scenario of market demand changes is vividly simulated by virtual reality technology, which in turn drives enterprises to develop flexible and adaptable production plans. Based on this, the rapid and ever-changing market environment cannot interfere with its solid progress.

### **5.3. Application of Virtual Reality Technology in Supply Chain Collaborative Management**

The practical application of virtual reality technology in the field of supply chain collaborative management enables participants in various supply chains to communicate and collaborate effectively in real time on a shared virtual platform. This comprehensive collaboration not only includes orderly sharing of information data, but also involves joint planning and coordinated execution of various complex and ever-changing supply chain processes. Through advanced and cutting-edge virtual reality technology, stakeholders in various key links of the supply chain can collaborate and participate in complex and tedious processes such as product design, production planning, and logistics arrangements, thereby achieving efficient resource sharing and perfect complementarity of advantages. This highly efficient collaborative work mode significantly improves and enhances the overall system's fast response speed and strong adaptability, while also reducing various potential risks in the operation process. In addition, this virtual reality technology can accurately and realistically simulate various possible diversified supply chain risk scenarios, such as supply interruptions or demand fluctuations, which can effectively help enterprises plan and formulate corresponding and effective response strategies in advance to ensure the stable operation of the entire large and complex supply chain system.

## **6. Conclusion**

The current socio-economic and technological development is rapid, and the development technology of clothing products is also iterating with the development of productivity. The potential of virtual reality technology in the development and application of clothing products is enormous, which can greatly improve work efficiency and product quality. From the virtual fitting digital design stage to the supply chain collaboration and production management stage, it has demonstrated strong advantages. The use of

virtual reality technology in product design, production management, and market tracking can further enhance the production efficiency and market advantage of enterprises.

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