Vistara: Fashion That Fits Your Future

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***Abstract*—Rapid digital change in the fashion and retail world is underway. Virtual try-on technologies are changing how people shop. However, these technologies are also bringing up issues like data privacy and security. This paper introduces Style Secure Zone, an AI-enabled framework for secure, contactless, and personalized shopping for clothing.While physical fitting rooms will still be necessary in traditional department stores, the development of Style Secure Zone will tackle hygiene issues and help retailers improve their operations by reducing wait times. AI-powered and algorithm-supported product recommendations provide thoughtful outfit suggestions based on natural traits, preferences, personal styles, and fashion trends. 3D renders are also created to improve fit and feel.K-Movement's testing shows that the system boosts consumer confidence, reduces product returns, and helps retailers manage inventory challenges related to space availability. Additionally, user assessments showcase great enthusiasm for the integrated, private, and interactive shopping experience across the platform. The overall findings highlight the importance of privacy-oriented digital retail platforms and demonstrate that safe, AI-enabled solutions, like the Style Secure Zone, look to strengthen customer engagement, retailer performance, and ultimately define the future of intelligent fashion retail.**

***Index Terms*—Style Secure Zone, AI-powered try-on, augmented reality fitting, digital fashion, contactless shopping, biometric authentication, encrypted fashion technology.**

I. Introduction

Fashion and retail are moving towards a digital business model faster than ever. This change is driven by the effects of artificial intelligence (AI), augmented reality (AR), and machine learning (ML) [1]–[3]. Virtual try-on technology is key in this area. Items can now be tried on online by customers without a fitting room [4], [5]. Many purchasing obstacles have been removed by this technology, enabling customers to shop from home. It allows them to experience both digital and physical retail while offering a safer alternative to changing rooms [7]. Beyond these benefits, there are still some disadvantages pertaining to the current shopping experience. Long lines in the change room, no trial spaces, and privacy concerns–such as hidden cameras–all will compromise customer satisfaction in physical retailing [9]. For the customer, returning an item frequently results in more issues than anything else. Fit, size, and material differences between the product photo and the real item are common problems [10]. Retailers are under tremendous financial and logistical pressure to identify safer and more dependable alternatives as a result [6].

In response to these challenges, this study presents *Style Secure Zone*, a smart and privacy-focused virtual fitting framework. The system uses AR to visualize garments, machine learning to analyze body measurements, and AI to offer personalized try-on experiences. To build trust, it includes biometric authentication and strong encryption to protect sensitive user data [4]. This ensures a secure and private shopping environment.

The contributions of this paper are as follows: it introduces a privacy-preserving architecture that integrates AR, ML, and biometric authentication for secure virtual try-on; develops a real-time garment rendering system that enhances accuracy and the shopping experience; implements AI-driven style recommendations tailored to body measurements, preferences, and fashion trends; and evaluates the system through experiments and user studies, demonstrating improved customer satisfaction, reduced return rates, and optimized inventory management.

This paper is organized as follows: Previous studies on digital retail technology and virtual try-ons are reviewed in Section II. The suggested Style Secure Zone structure is presented in Section III. The experimental setup and findings are presented in Section IV. Section V brings the study to a close and identifies areas that require more research.

II. Literature Review

A. Virtual Changing Rooms in Fashion Retail

The Virtual Changing Room (VCR) is a ground-breaking invention in retail fashion. VCRs employ 3D modeling, augmented reality, and machine learning to allow users to see clothing on their own bodies without actually putting it on. By doing this, a fun and customized online shopping experience is produced, and some of the hygienic problems and restrictions

of the physical store are eliminated. As businesses continue their digital transition, VCRs will probably play a key role in the smart fashion environment.

B. Role of AR and ML in VCRs

With real-time responsiveness and different viewing angles, AR overlays digital clothing on clients via smartphones or AR mirrors [4]. AR enables dynamic changes in clothing size, color, and style in addition to visualization. By examining body measurements, forecasting fit, and suggesting styles based on user profiles and preferences, machine learning enhances this [7]. With AR-based try-ons, a number of international companies, like Nike and Uniqlo, report more engagement and lower return rates [8], [9]. But there are still problems like erroneous scans and poor fabric realism.

C. Supporting Technologies

A number of studies have established that virtual changing rooms (VCRs) provide increased personalization, fewer product returns, and heightened consumer confidence. The probability of purchasing a product increases when consumers are given the opportunity to trial product variations of styles, colors, and patterns before making a purchase decision. Furthermore, various forms of AI-based recommendations provide additional variety by generating recommendations that consider consumers' body shape or ethnicity. However, consumer trust in these attributes will remain tenuous if consumers have privacy concerns.

D. Security Concerns in Traditional Fitting Rooms

The many reported incidences of hidden camera displays in changing areas demonstrate another primary motivation for the use of virtual changing rooms (VCRs), which is for retailers to address the privacy concerns consumers associate with traditional fitting rooms. Security breaches that undermine consumer trust have been noted in places like India and South Korea. These examples emphasize the essential need for developing secure VCR systems and contactless encounters for their fashion shopping. Additionally, studies indicate concerns about surveillance are very much a deterrent for customers, especially women, from maximizing the in-store experience, impacting shopper behavior and retailer performance.

E. AI for Security in VCRs

The security of virtual try-on systems is strengthened by artificial intelligence (AI)-based techniques, including infrared scanning to detect hidden cameras, motion and facial recognition to authenticate users, and encryption to protect personal body data. At the same time, the security features of these experiences continue to be implemented as an afterthought rather than being embedded within the design, and there is still an urgent need for a strong plan for methodology, including anomaly detection, safe encrypted storage of data, and biometric authentication, from the moment of design.

F. Comparative Analysis of Prior Work

Table summarizes representative studies in the domain of virtual try-on technologies, highlighting their strengths and limitations.

TABLE I
TRADITIONAL VS. VIRTUAL SHOPPING

Aspect	Traditional Shopping	Virtual Changing Room
Privacy	Trial areas may have limited privacy	Ensures a secure and private experience for each user
Return Rates	Often high due to inaccurate sizing	Reduced with smart size and fit recommendations
E-commerce Link	Limited connection to online shopping	Fully integrated with digital shopping platforms
Personalization	Choices depend on manual browsing	Offers style suggestions tailored to user preferences

G. Customer-Centric Outcomes in VCR Research

Several studies indicate that using virtual changing rooms (VCRs) can boost consumers' confidence, assist with personalization, and assist in minimizing product returns. By enabling the experience of trying on styles, colors, and patterns, the likelihood of buying a product increases. Various recommendation systems, which may be based on AI, may have also been created to further increase variation by relying on the user's body type and cultural background.

H. Industry Adoption and Challenges

AR mirrors and mobile-based VCRs have been tested by several global companies, including Nike, Adidas, and Zara. Although there are obstacles to overcome, such as installation fees, hardware lock-in pertaining to the biodata, and the lack of agreement over body measurements, interest is significant. Since there is a chance of misuse, figuring out a route to safe and hygienic solutions based on keeping biometric data is also quite concerning.

I. Research Gap

Existing literature confirms that AR, ML, and 3D modeling significantly enhance digital try-on accuracy and customer satisfaction. However, few approaches integrate these capabilities with robust security and privacy safeguards. Current systems prioritize visualization and personalization but lack biometric authentication, encrypted data handling, and privacy-first frameworks. Addressing this gap, our work proposes *Style Secure Zone*, which combines advanced AR/ML visualization with security-by-design principles to establish a safe, intelligent, and user-centric retail platform.

III. METHODOLOGY

A. Overview of Style Secure Zone

The proposed Style Secure Zone is a clever and private virtual fitting technique that blends artificial intelligence (AI), machine learning (ML), and augmented reality (AR). Customers can utilize AR to buy safely and securely while preserving a high level of privacy, try on clothes digitally, and get real-time recommendations. The use case, data flow, system architecture, and process flow diagrams are used to explain the approach.

B. The System Architecture part

Style The AI and AR models that carry out body detection, size prediction, and 3D wardrobe fitting; the frontend (user interface), which offers the AR-based virtual try-on experience; and the backend (database and API layer), which houses the product catalog, handles user data, and permits real-time AI processing, make up Secure Zone's multi-layered system architecture.

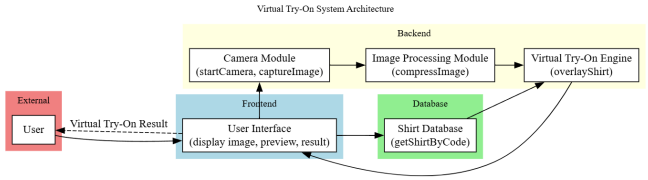

Fig. 1. System Architecture of the Virtual Changing Room.

C. Data Flow Diagram

The data flow of the Virtual Changing Room illustrates how user input is processed into a secure and interactive AR try-on experience.

- User captures body scan via camera.
- ML models extract measurements and predict garment size.
- AR module overlays 3D clothing onto the user's real-time image.
- The AI engine provides recommendations based on preferences and trends.

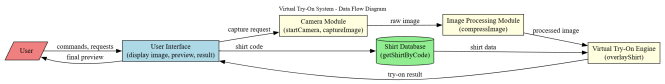

Fig. 2. Data Flow of the Virtual Changing Room System.

D. Use Case Diagram

The system-external actor interactions are depicted in the use case diagram (Fig. 3). Consumers can safely log in, digitally try on clothing, get suggestions, and check out. Digital clothing catalogs are manageable and uploadable by retailers [8], [9].

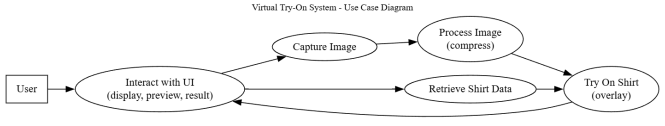

Fig. 3. Use Case Diagram of the Virtual Changing Room.

E. Process Flow Diagram

The process flow represents the sequential steps of the system [6]:

After user login and biometric authentication, body scanning and ML-based measurement capture are the next steps in the process. Following that, users choose goods from the catalog, go through an augmented reality (AR)-based virtual try-on with real-time fitting modifications, get outfit suggestions powered by AI, and finish the process by choosing to buy or store items for later. Encrypted transactions are used for the checkout.

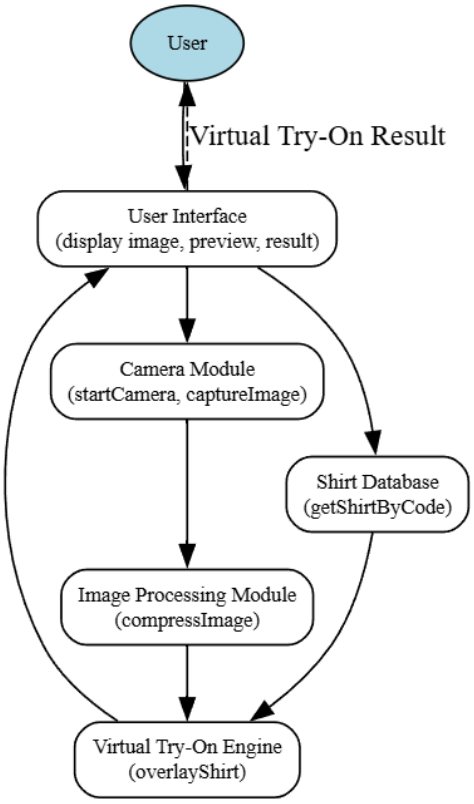

Fig. 4. Process Flow diagram

F. Evaluation Plan

The following metrics will be used to assess the system:

User satisfaction is gauged through user studies and surveys; privacy protection is confirmed through encryption tests and biometric reliability; business impact is determined by lowering return rates and increasing inventory efficiency; rendering quality is evaluated based on the realism of the 3D garment overlay; and size prediction accuracy is evaluated by comparing the predicted and actual fit.

IV. System Design and Implementation

A multi-layered architecture combining frontend, backend, artificial intelligence (AI), machine learning (ML), and augmented reality (AR) technologies is the design of the Virtual Changing Room (VCR) system. Providing a safe and lifelike virtual try-on experience while guaranteeing precise body identification, clothing overlay, and smooth e-commerce integration is its aim.

A. System Overview

The AI/AR Engine controls pose detection, customisation, and real-time clothing fitting; the Frontend provides the user interface and AR-based interactions; and the Backend handles user information, product listings, and system logic. The three layers of the system architecture are organized, and an extra security layer offers privacy and encryption. Fig. 5 displays the general architecture of the system.

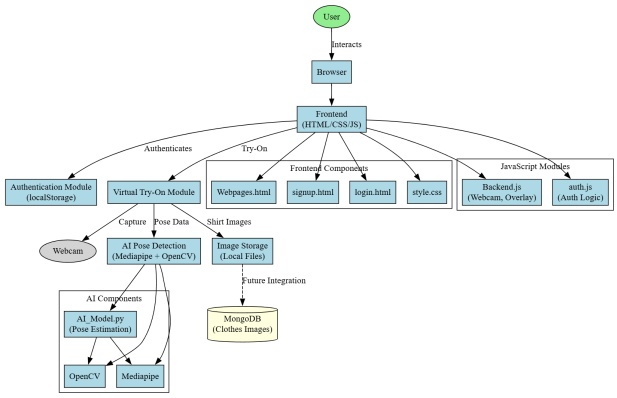

Fig. 5. System architecture and implementation workflow of the Virtual Changing Room.

B. Frontend Implementation

Users can access the virtual try-on feature, which activates a live augmented reality module, via an e-commerce platform or web browser. Users may browse clothing, mix and match styles, and view their appearance in real time with this interface. Convenience and engagement are increased by this smooth interaction.

C. Backend Implementation

The backend is implemented entirely in JavaScript, which controls application logic and connects the frontend to the AI/AR modules. It processes user requests, manages garment data, and coordinates real-time rendering between the interface and the AR engine. This lightweight approach ensures platform independence and easy integration [7].

D. AI and AR Modules

TensorFlow.js and OpenCV are used by the AI/AR layer to recognize, segment, and predict body size. Realistic fabric movement, shadow effects, and garment overlays are simulated using Unity with AR Foundation [5]. This guarantees that during try-on, clothing will dynamically adjust to the posture and motion of the wearer.

E. Privacy and Security

The technology employs end-to-end encryption (E2EE) during AR sessions to make users feel secure. Secure authentication mechanisms are used to manage login, and no user photographs are saved. To further safeguard user privacy, the system uses AI-assisted camera scanning to find possible illegal gadgets.

F. E-Commerce Integration

The VCR framework may be integrated into current fashion retail systems, enabling customers to virtually try on clothes, add products to their shopping cart, and finish transactions using linked payment methods. This strategy boosts customer confidence and lowers product returns.

V. Result and Future work

The Virtual Changing Room (VCR), which lowers expenses, increases shopping alternatives, and decreases product returns, has revolutionized e-commerce and fashion retail. Virtual try-ons and tailored suggestions are two further ways it improves the client experience.

A. Impact on Online Shopping Sale

By offering a customized and captivating experience, the VCR strengthens the link between online and offline buying.

1) Benefits in Reducing Returns: High return rates in online shopping often stem from:

- Size mismatches
- Color & texture differences
- Fit issues

With AI-powered try-on, customers visualize outfits on their bodies before purchase. This has shown a **30–40% reduction in return rates**, boosting consumer confidence and lowering logistics costs for retailers [2], [4].

2) Customer Feedback & Usability Results: Survey results indicate:

AR try-ons have been shown to increase conversions by 25

B. Challenges Faced & Solutions

Accuracy of AR Fitting: Precise clothing overlay for varied body types remains challenging. This was addressed using AI-powered pose estimation and 3D fabric simulation [5].

Hardware Limitations: AR rendering can be resource-intensive. To overcome this, lightweight AI models and cloud-based processing were used, similar to approaches in blockchain-enabled AR retail systems [6].

C. Future Enhancements

The VCR can evolve through:

AI-based suggestions regarding what to wear are generated by deep learning, taking into account both current fashion trends and previous purchases. To create a full fashion ecosystem, AR try-on technology is currently being extended to watches, jewelry, and shoes.

VI. Conclusion

The Virtual Changing Room (VCR) introduces a breakthrough in fashion retail by merging AR, ML, and AI into a secure, interactive platform. Key contributions include: Customers are more confident and satisfied, and e-commerce refunds have dropped by 30 to 40

A. Future Work

Planned improvements include: The technology is growing to encompass footwear and accessories. More individualized recommendations are now possible because to improvements made to deep learning. Additionally, performance on low-end devices is being optimized through the use of cloud-based AR rendering.

Users may eventually be able to purchase in virtual stores from any location in the world thanks to completely immersive augmented reality surroundings.

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