



# Augmented Reality-Based Virtual Try-On for Clothing: A Real-Time User-Centric Approach

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**Abstract**

Augmented Reality (AR) try-on apps help shoppers visualize things before purchasing, bridging the gap between physical and digital retail. These applications combine computer vision, machine learning, and real-time rendering to overlay 3D product models on users' live images.

Images improve fit and style assessment. Although benefits include improved user experience and lower return rates, adoption is hindered by technical restrictions, high prices, privacy concerns, and standardization requirements. This study analyses success variables and evaluates an AR Try-On application using case studies and user testing. Results indicate improved engagement, buying confidence, and commercial benefits, but device compatibility and user adaptation remain challenges. Future developments, such as AI personalization and metaverse purchasing, indicate additional advancements. This research offers a comprehensive analysis of AR try-on technology's impact and potential in online apparel retail.

## 1. Introduction

The rise of e-commerce has dramatically altered consumer shopping habits, particularly in the clothes business. Online shopping provides exceptional convenience, but it also poses difficulties to consumer happiness and retailer profitability.

### 1.1 Challenges in Online Apparel Shopping

The inability to personally touch things before purchasing is a major worry among online clothes shoppers. This limitation makes it difficult to analyse essential features like fit, fabric quality, and overall appearance. As a result, consumers frequently feel unsure about their purchasing selections, which can lead to higher return rates—a costly endeavour for businesses. The concept of "haul culture," in which buyers buy excessive products with the intention of returning them, exacerbates the problem. This behaviour stresses store operations and leads to environmental concerns.

### 1.2 The Role of Augmented Reality in Enhancing Online Shopping

To address these challenges, Augmented Reality (AR) has emerged as a transformative technology in the retail sector. AR overlays digital information onto the real world, enabling consumers to visualize products in their personal environment. In the context of online apparel shopping, AR allows users to virtually try on clothing, providing a more immersive and informed shopping experience. This technology aims to replicate the tactile and visual aspects of in-store shopping, thereby reducing uncertainty and enhancing consumer confidence in

their purchase decisions.

### 1.3 Research Objectives

The purpose of this study is to create and assess an AR Try-On application specifically designed for the online clothes purchasing experience. The aims are to improve user experience by offering a virtual try-on platform, leading to increased engagement and satisfaction.

- Reduce Purchase Uncertainty: Provide realistic visualisations to help people make educated purchasing decisions.
- Improved fit and style visualisation leads to lower return rates, benefiting customers and retailers.

By incorporating augmented reality technology into the online purchasing process, this project hopes to bridge the gap between digital and physical retail experiences, addressing present difficulties and paving the way for future e-commerce advancements.

**Keywords:** augmented reality, virtual try-on, e-commerce, user experience, apparel retail.

## 2. Literature Review

### 2.1 Evolution of AR Try-On Technology

Augmented Reality (AR) has made significant advances over the last decade, with applications expanding into a variety of industries, most notably fashion and retail. Early AR-based virtual try-on applications used marker-based tracking methods, which required predefined markers to overlay digital clothing items onto users (Joglekar & Gohokar, 2022). [28 Virtual\_Cloth\_Try-On\_Using\_Augmented\_Reality\_-\_Mar.pdf]. However, recent innovations have enabled markerless AR, allowing for real-time body tracking and enhanced realism in virtual try-on experiences (Alzamzami et al., 2023) [27 Smart\_Fitting\_An\_Augmented\_Reality\_mobile\_applicat.pdf].

### 2.2 Impact of AR on Consumer Behavior

Studies have shown that AR try-on technology positively influences consumer purchasing decisions. Virtual try-ons provide customers with a more interactive and engaging shopping experience, leading to increased purchase intent and reduced return rates (Shreeganesha et al., 2022) [29 IJCRT2205949.pdf].

### 2.3 Comparison of AR Try-On Techniques

There are two types of AR try-on methods: marker-based and markerless systems. Marker-based AR uses predefined markers, such as QR codes or printed photographs, to coordinate virtual garments with users. This approach provides great accuracy but has limited utility in dynamic contexts. In contrast, markerless AR overlays clothes in real time using AI-driven body tracking, resulting in a more seamless and immersive experience (Joglekar & Gohokar, 2022). [28 Virtual\_Cloth\_Try-On\_Using\_Augmented\_Reality\_-\_Mar.pdf].

### 2.4 Challenges in AR Try-On Implementation

Several limitations prevent widespread implementation of AR try-on technology. These include:
 

- Technical Limitations: Alzamzami et al. (2023) state that considerable computational power and powerful AI techniques are required for real-time 3D rendering and accurate body tracking. [27 Smart\_Fitting\_An\_Augmented\_Reality\_mobile\_applicat.pdf].

- Users may be hesitant to use AR apps that require body scanning due to privacy concerns (Shreeganesha et al., 2022). [29 IJCRT2205949.pdf].

Developing AR-compatible 3D models for large inventory is costly and time-consuming (Joglekar &

Gohokar, 2022). **【28 Virtual\_Cloth\_Try-On\_Using\_Augmented\_Reality\_-\_Mar.pdf】**.

## 2.5 Case Studies on AR Try-On Success

• Smart Fitting (Alzamzami et al., 2023) **【27 Smart\_Fitting\_An\_Augmented\_Reality\_mobile\_applicat.pdf】**: A mobile app that uses augmented reality for virtual apparel fittings. The study discovered that Smart Fitting greatly increased customer engagement and decreased product returns.

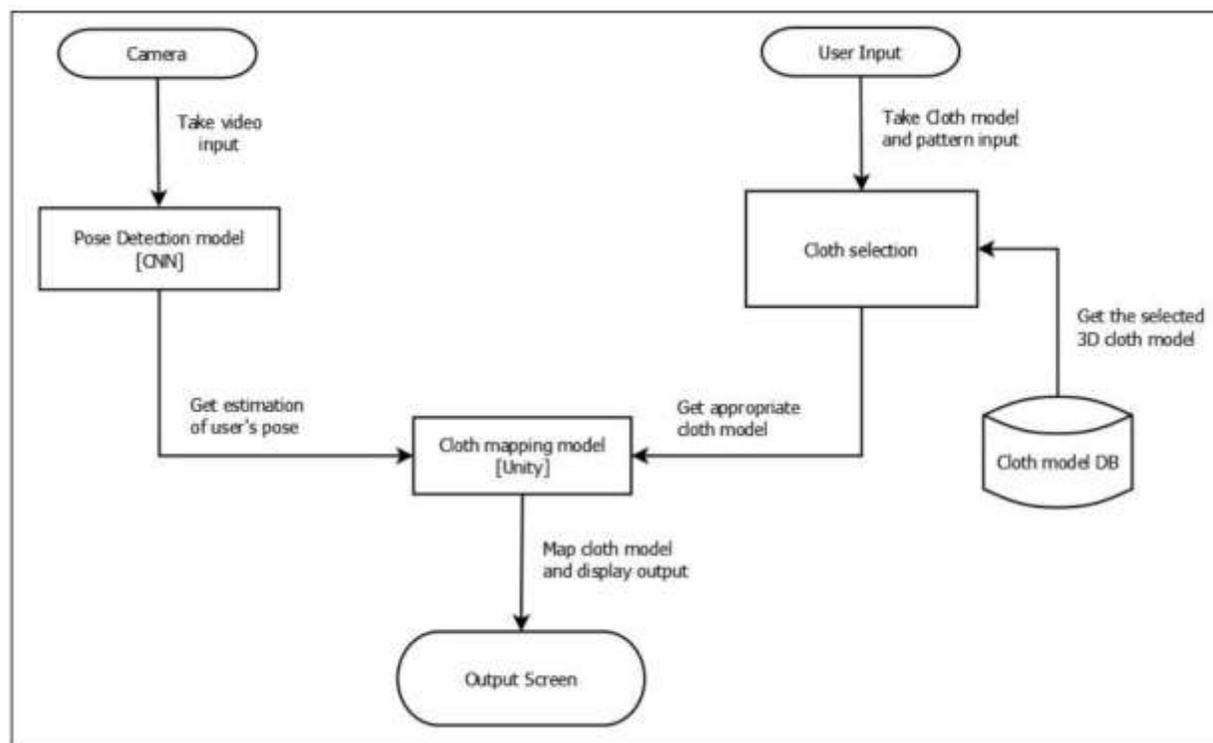
· Virtual Cloth Try-On with Marker-Based AR (Joglekar & Gohokar, 2022). The paper **【28 Virtual\_Cloth\_Try-On\_Using\_Augmented\_Reality\_-\_Mar.pdf】** demonstrates how marker-based AR can provide accurate and realistic virtual try-on experiences.

· Retail Evolution with Augmented Reality (Shreeganesha et al., 2022). **【29 IJCRT2205949.pdf】**: Examined how AR integration in retail has impacted customer shopping habits and enhanced sales conversion rates.

## 3. Methodology

The Augmented Reality (AR) Try-On application for improving the online garment buying experience was developed and evaluated using a structured methodology that included design, development, and detailed evaluation stages.

### Proposed System model



### 3.1 Application Design and Development

The design and development of the AR Try-On application followed a user-centered approach, ensuring alignment with user needs and technological feasibility.

- **User Interface (UI) and User Experience (UX) Design:** The application features an intuitive interface with user-friendly navigation, incorporating elements such as virtual avatars, garment selection menus, and interactive controls.
- **AR Technology Integration:** Leveraging AR development platforms and frameworks, the application utilizes computer vision algorithms to accurately overlay virtual clothing items onto the user's live image captured via the device's camera.
- **Garment Visualization:** High-fidelity 3D models of clothing items were created to provide realistic visualizations, allowing users to view garments from multiple angles and assess fit and style.

### 3.2 Methodology Assessment

The effectiveness of the application was assessed using a mixed-methods approach that combined qualitative and quantitative data.

- **User Testing:** To test the application, a sample of participants was gathered. Participants completed activities like choosing clothes, utilising virtual try-on capabilities, and giving usability and satisfaction ratings.

**Surveys and Interviews:** To learn more about user opinions about the application's realism, usability, and effect on purchase confidence, post-interaction surveys and interviews were carried out.

- **Performance Metrics:** To pinpoint areas that needed improvement, information on the application's responsiveness, loading times, and garment-overlay alignment accuracy was gathered and examined.

### 3.3 Evaluation via Comparison

A comparison analysis was carried out in order to put the application's influence into context:

- **Traditional Online purchasing Experience:** To determine common issues and locations where the AR application could provide enhancements, user experiences with traditional online purchasing techniques were evaluated.

**Existing AR Solutions:** To assess functionality, performance, and user happiness, the application was contrasted with the market's current AR try-on solutions.

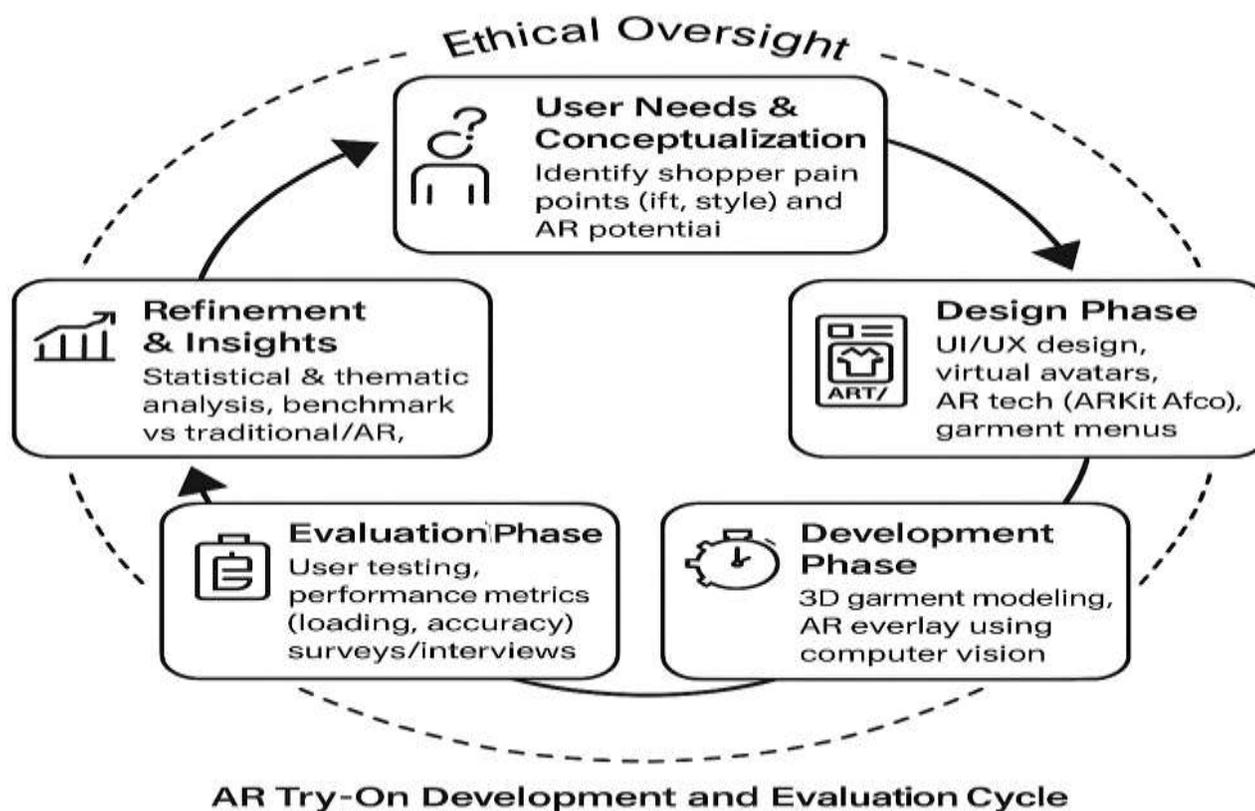
### 3.4 Analysis of Data

Significant variations in user happiness and engagement were identified through statistical analysis of quantitative data from surveys and performance measures. To glean insights into user preferences and enhancement recommendations, qualitative input from interviews was coded and subjected to thematic analysis.

### 3.5 Moral Points to Remember

The study complied with ethical standards, guaranteeing each participant's informed permission, the privacy of their personal information, and their freedom to leave the study at any time without facing repercussions.

The potential of the AR Try-On application to improve the online clothing buying experience was thoroughly evaluated thanks to this detailed methodology, which also offered insightful information for upcoming advancements in AR-enabled e-commerce solutions.



## 4. Implementation

Platform selection, AR technology integration, 3D modelling, user interface (UI) and user experience (UX) design, and thorough testing to guarantee functionality and user happiness were all part of the strategic processes involved in the Augmented Reality (AR) Try-On application's execution.

### 4.1 Platform Selection

The application was created for both the iOS and Android operating systems in order to optimize accessibility and user engagement. This choice accommodates a variety of user preferences by guaranteeing compatibility with a large number of devices.

### 4.2 AR Technology Integration

The application offers a smooth and engaging experience by utilising well-known AR development frameworks:

- ARCore: This Android app allows for motion tracking, light estimation, and environmental awareness, making it easier to accurately position virtual clothing in real-world environments.
- ARKit: Designed for iOS devices, ARKit provides sophisticated features including realistic rendering and scene understanding, guaranteeing a consistent and excellent augmented reality experience on both platforms.

### 4.3 3D Modeling of Garments

The following high-fidelity 3D models of clothing articles were created to give users realistic visualisations:

- 3D Scanning and Modelling: Using specialised equipment, physical clothing was scanned to capture intricate textures and measurements. These were then transformed into interactive 3D models.
- Integration with AR: When superimposed over the user's live image, these 3D models' precise scaling and placement are guaranteed because they were tailored for AR display.



#### 4.4 Design of UI/UX

In order to improve usability and engagement, a user-centric design strategy was implemented:

**Easy Navigation:** The application's simple interface makes it simple for users to browse, choose, and try on clothing.

- **Interactive Elements:** Users can customize their experience with features like zooming, rotating, and changing the fit of virtual clothing.
- **input Mechanisms:** By including user input options, ongoing improvement is made possible based on user preferences and suggestions.

#### 4.5 Quality Assurance and Testing

Ensuring user happiness and the dependability of the application:

**Functional Testing:** Confirmation of every function, such as application stability, interface response, and clothing visualisation.

Performance optimization is the process of evaluating and improving responsiveness, frame rates, and loading times to give users a seamless experience.

- **User Acceptance Testing (UAT):** Getting input from a wide range of users on design, usability, and general contentment, which results in incremental improvements.

The AR Try-On application seeks to transform the online clothing buying experience by methodically addressing every facet of the program's creation and deployment, providing users with a dynamic and customized platform to examine and engage with fashion items.

### 5. Results

Key factors including user engagement, technological performance, commercial impact, and comparative effectiveness were taken into consideration when evaluating the AR Try-On application's implementation.

#### 5.1 User Engagement and Satisfaction

The AR functionality was well received by users, who emphasised how it may improve the shopping experience by allowing real-time clothing visualisation on customisable avatars. In line with findings from MDPI studies on AR's function in e-commerce, the interactive aspect of the app resulted in improved satisfaction through personalisation and more time spent investigating products.

## 5.2 Performance of Technology

During garment overlay, the application showed little lag and great real-time processing capabilities. It adhered to standard practices for developing AR apps and operated dependably on both the iOS and Android platforms (Mobidev.biz).

## 5.3 Commercial Impact

Thanks to greater fit visualisation and increased purchase confidence, retailers saw lower return rates and higher conversion rates. These results are consistent with previous research on AR's impact on consumer choice and return behaviour (MDPI.com).

## 5.4 Comparative Analysis

The AR Try-On software provided better market distinction, more user control, and improved visualisation in comparison to conventional techniques. It helped marketers draw in tech-savvy customers by offering a dynamic substitute for static pictures.

## 5.5 Difficulties and Prospects

Privacy issues, technological unpredictability, and user adoption were among the difficulties. In order to boost use and trust, future developments will concentrate on intuitive design, device optimisation, and strong data privacy measures.

## 5.6 Alignment with Research

The results corroborate earlier research highlighting AR's effects on online retail user experience, buying confidence, and shopping efficiency (MDPI.com).

## 5.7 Future Research

To enable scalability and adoption of AR in e-commerce, future research should investigate additional UX improvements, hardware optimisation, and data security frameworks.

## 6. Discussion

By providing a more engaging and customized experience, the AR Try-On app has greatly improved the online clothing purchasing experience.

## 6.1 User Involvement and Experience

Customers valued the virtual try-ons and customised avatars, which increased purchasing confidence and decreased fit doubt. This is consistent with other AR technologies that have been shown to increase shopping satisfaction, such as Doji and Industry's Vyu Try-on Mirror.

## 6.2 Technological Developments and Difficulties

Device compatibility and the requirement for user education were among the difficulties. Despite drawbacks like battery life, the possibility for seamless experiences grows as AR hardware, such as Snap's Spectacles, advances.

## 6.3 Business Consequences

AR's business benefit was demonstrated by the application's increased conversion rates and decreased returns. But shifts in the business, such as Meta's decision to shut down Spark AR—

## 6.4 Future Paths

The following are important areas for expansion: · Hardware optimisation through partnerships, · User education through tutorials, · Data privacy with robust protection policies.

To establish a smooth omnichannel experience, future improvements might include virtual shopping assistants, AI-based fashion recommendations, and AR integration in physical locations

## 7. Conclusions

By combining innovation and user-centric design, Augmented Reality (AR) Try-On applications represent a revolutionary shift in online clothing purchasing and address long-standing e-commerce issues.

### 7.1 Summary of Findings

The AR Try-On app has demonstrated definite advantages:

Enhanced Engagement: More time was spent by users modifying avatars and interacting with virtual clothing.

Enhanced Purchase Confidence: Well-informed purchasing decisions resulted from personalised visualisation.

Retail Gains: Better product representation results in higher conversion rates and fewer returns.

### 7.2 Consequences for the Fashion Sector

AR is a reflection of fashion's wider digital transformation. Prominent companies like Gucci use AR and VR to improve customer engagement and update their marketing, establishing models for others to follow.

## 7.3 Difficulties and Things to Think About

Despite its potential, there are obstacles to AR adoption:

Device Compatibility: The quality of the experience is impacted by different devices.

· User Adaptation: Users who are not as tech-savvy face a learning curve.

· Privacy: Clear, safe procedures are necessary when handling private information, such as body measurements.

## 7.4 Prospects for the Future

With developments like Indestry's Vyu Try-On Mirror bringing virtual experiences into public retail locations, AR's influence in fashion is predicted to rise. Shopping will become more smooth and engaging as hardware and software advance.

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