

# Wolive – Online Shopping Application with Virtual Fitting Room

**Gunasekare U.D.V.D, Athukorala K.A.D.P.S, Serasinghe S.M.V.M, Rajapaksha R.P.G.T, D.I De Silva, Gunthalike M.P**

*Department of Computer Science and Software Engineering  
Sri Lanka Institute of Information Technology  
Malabe, Sri Lanka*

**Abstract:** - The objective of this study was to provide an efficient and interactive online shopping experience to customers. The fashion industry plays a pivotal role in the economic landscape of any nation. Traditionally, people are used to physical clothing stores. However, with the emergence of the digital era and recent increase in the number of online retail stores, more citizens have shifted to online shopping. While online shopping brings many benefits like time saving and worldwide accessibility, it also brings about problems of sizing and fitting or clothing relying only on measurements. In response to these problems, Wolive platform was developed. This is a fully functional online shopping platform with a virtual fitting room feature. Customers can browse through a wide range of clothes in the store and virtually try them on a 3-Dimensional model generated using Artificial Intelligence technology according to their precise measurements. This will portray the fit of the clothing item on the customer uniquely, helping in their decision-making process and improving efficiency of the overall shopping experience. Customers can then securely pay and place their orders. Wolive platform also provides functionality for site administrators to manage the inventory.

**Keywords:** 3-Dimensional model, artificial intelligence, fashion industry, virtual fitting room, online shopping, customer satisfaction.

## 1. Introduction

The fashion industry has undergone a remarkable evolution over the past few decades, transitioning from its traditional departmental store roots to the dynamic and expansive realm of online shopping. This shift has been driven by a convergence of technological advancements, changing consumer behaviors and the even quickening pace of the fashion landscape. In the past, fashion enthusiasts would peruse racks in stores or flip through glossy catalogs to get their hands on the latest fashion trends. However, the advent of the internet in the late 20th century unleashed a wave of change that reshaped the fashion industry's very foundation.

The rise of online shopping platforms and the increase of fashion websites enabled brands to not only showcase their creations to a global audience but also to sell directly to consumers without the constraints of physical shelf space. This shift democratized the industry, granting newfound visibility to emerging designers and allowing consumers to access an unprecedented array of styles from the comfort of their screens. With the pandemic that happened in the past few years, this shift from physical shopping to online shopping surged even higher [1]. Fig. 1 portrays the increase in revenue of retail e-commerce sales. According to Fig. 1 the revenue has increased 4 times over the 9-year period. The revenue is also predicted to increase further over the next few years [2].

However, there are a few significant challenges faced in the realm of online fashion shopping, that deeply impact the overall shopping experience. One prominent issue that often irritates customers is the matter of sizing in styling. As illuminated in [3], this predicament holds particular significance. When shopping in physical stores, customers have the advantage of trying on garments to assess their fit and style. Absence of the fit-on facility in online shopping has caused displeasure due to incorrect fit once customer receives the clothing [4]. Furthermore, customers could also verify that the colors match their skin tones. However, the transition to online shopping

removes this experience, leaving customers reliant on size charts and product descriptions. It may also be a challenge to display the colors as they are. This absence of fitting features has led to a decline in customer interest when it comes to purchasing clothing items from online stores. The issue stems from the diverse body shapes, diverse skin complexion colors and the dynamic nature of dress sizes, which complicate the suitability of garments. The paper delves into the complexities of this challenge, shedding light on how the development of this new solution will solve the issues faced in the absence of physical interaction with the product that can lead to confusion, misinterpretation of sizing information, and ultimately, the disappointment of receiving ill-fitting garments.

The above challenges will lead to unsatisfied customers, in turn leading to loss of revenue and downfall of businesses. Therefore, after understanding the depth of these challenges and utilizing advanced Artificial Intelligence features, a solution was developed to address these issues. The proposed system introduces a transformative web application aimed at addressing the challenge of accurate cloth fitting in the realm of online shopping. By using cutting-edge technology, this application generates a tailored 3D model unique to each user's body measurements and skin complexion. This digital representation serves as the model for a virtual fitting room experience, allowing customers to virtually try on selected clothing items and assess their compatibility with their specific body proportions. An important and unique feature of the system is the ability to portray the fit of the clothing on the user's body. This allows user to alternate through various sizes to find the best fit size thus eliminating the reliance on size charts. This feature empowers shoppers with a good understanding of how various clothing options would fit their body shape, revolutionizing the online shopping experience, and mitigating fit-related uncertainties. This solution not only smoothens the online shopping process but also elevates user confidence, by providing a sense of control and personalization in the digital fashion landscape.

The primary objective of the proposed solution is to enhance the online shopping experience to especially identify the 'fit' of clothes by introducing an interactive virtual fitting room within the web application. To achieve this main objective, the sub objectives identified are listed below.

- Create an interactive virtual fitting room within the web application, enabling users to virtually try on selected clothing items using their personalized 3D model.
- Provide users with the ability to visualize how different clothing sizes fit their 3D model, helping them make accurate sizing assessments.
- Minimize time wastage in the shopping process by offering an efficient and effective means of trying on and evaluating clothing items, reducing the need for multiple purchases and returns.
- Boost user confidence by offering an accurate visual representation of how clothing items will fit and look, mitigating the apprehensions associated with online shopping.

The next section provides a Literature review of systems that enhance the online shopping experience in retail. This section will mainly focus on systems that include the virtual dressing room technologies and analyze them. Following the Literature review section will be the Methodology. This section will include a Results will follow the methodology section where the results of the solution will be presented followed by a discussion of the findings and their implications. Finally, the paper's conclusion will involve summarizing the principal discoveries and providing suggestions for future research endeavors.

## 2. Literature Review

This section of the paper will discuss and analyze the numerous research endeavors and solutions developed to address these concerns over the last decade. Virtual fitting rooms have become the ultimate solution for overcoming these challenges. Each solution has utilized diverse methodologies and technologies to propose distinct solutions, each with its own advantages and drawbacks.

A survey conducted by undergraduates of SLIIT [5] concluded the following outcomes and prevailing issues in the realm of online clothing purchases. The absence of physical fitting rooms prevented customers from getting

an accurate grasp of the clothing sizes they're buying, resulting in potential mismatches. Additionally, the absence of an option for trying on clothes leads to discomfort and dissatisfaction with the look and feel of the purchased items, even when sizes are correct. The survey also indicated that many participants favored online platforms for their clothing shopping needs, magnifying the significance of these issues in the online shopping experience. Traditional brick-and-mortar stores offer the advantage of fitting rooms and readily available assistance from sales staff or companions, setting them apart from online platforms. This underscores the service disparity between the two shopping methods.

Fitiquette represents a prime example in this field which uses a virtual mannequin, Alien, to model clothing featured on their website [6]. Users log in to the platform and generate personalized avatars that emulate their body shapes and measurements. However, unlike other fitting room solutions that solely rely on user input, Fitiquette's approach involves precise measurements for garments in various sizes, factoring in attributes like fabric weight, natural drape, and elasticity. These considerations result in 360-degree visual renderings on the 3D avatar model.

FXMirror is yet another similar solution that bridges the gap between online and offline retail experiences through its virtual fitting platform [7]. It uses a Kinect camera to automatically capture users' body dimensions in real time and Augmented Reality to let users visualize how clothes would look on them. UPCloud uses the power of the computer's webcam to provide personalized sizing recommendations for clothing. The process begins with a simple calibration step where users stand in front of a camera. Once calibrated, this technology can seamlessly integrate with various online shopping sites, ensuring users choose clothes with accurate sizes [8].

Facecake's Swivel, a virtual fitting room, applies clothing to a live image of the customer in real-time [9]. This enables customers to envision a more attractive appearance. However, Swivel exclusively employs fixed 2D models for clothing and doesn't consider individual body contours or movements. Fits.me operates by allowing users to create personalized 3D avatars that accurately reflect their body measurements. It typically accepts several Measurement Input such as height, weight, chest size, waist size, hip size, etc. This data is used to generate a virtual model that closely resembles the user's physique. The user is then given the facility to try on clothes virtually on the model. Meepl revolutionizes virtual fitting rooms by incorporating users' uploaded photos to create personalized avatars. What sets Meepl apart from other solutions is it captures users' individual body language and movements, offering real-time simulations of clothing behavior as they shift and pose. This dynamic integration delivers an authentic virtual try-on experience that enables users to not only assess fit but also experience how garments would realistically move and interact with their own bodies [10].

Overall, most of the above systems use 3D camera and laser technologies to gather three-dimensional data of customers, facilitating the computation of body shape and measurements. Bodymetrics is an example, which operates on the foundation of Microsoft Kinect to gather customer body proportions [11]. Fitnect is another solution that operates in a manner like real-time virtual 2D image/video techniques [12]. Here, Microsoft Kinect captures input video and depth/3D data from the user instead of conventional image/video inputs. However, the specific technologies and implementations of each solution differ.

### 3. Methods

The application to be developed involves the establishment of an online retail platform that encompasses a diverse array of clothing catering to women, men, and children. Retail administrators will be able to manage the clothing inventory. Upon engaging with the platform, customers are presented with a wide selection of clothing options to peruse. Notably, the integration of a unique virtual fitting room features gains prominence. This feature introduces a novel dimension by conjuring a three-dimensional digital representation of the user, the "model," which is rendered based on precise body measurements and skin complexion colors. This model then serves as a medium through which users can virtually evaluate the fit of diverse pieces of clothing.

The uniqueness of this feature resides in its capability to simulate the act of physically trying on garments in terms of size and fit. Users can ascertain how different sizes of a garment would adhere to their virtual form, assessing the appropriateness of fit – whether it fits optimally, exhibits excess looseness, or presents an undesired tightness. This critical information empowers users to discern and select garments that conform to their individual preferences. Following this process, users can seamlessly progress to the acquisition phase, where they can add their clothes to a virtual cart and continue to a secure and streamlined payment gateway. Moreover, user engagement is further enriched by the ability to contribute opinions and perspectives through the integration of a rating and review system. This mechanism endows consumers with the ability to partake in shaping the shopping experience.

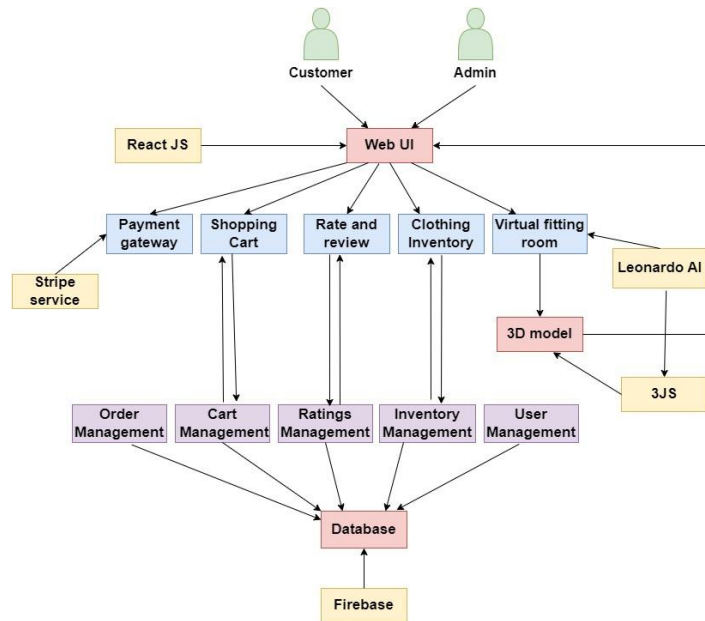


Fig. 2. System Overview Diagram

Fig. 2 portrays the overview of the system. Customers and Admins interact with the User interface to access the shopping cart, clothing items, rating system, virtual fitting room and payment service. These frontend components get data from the corresponding backend components available in the database.

A methodical approach is followed, that incorporates modern technologies to ensure an efficient system. We use the following technologies. React JS technology was utilized to build a user-friendly and interactive front-end interface, ensuring a smooth experience for all users. Firebase database is employed to manage the backend operations. It handles tasks like data storage and retrieval, image storage and ensures efficient and reliable handling of information. Artificial Intelligence technology was used for Model Generation. Leonardo AI plays a crucial role in creating accurate and advanced 3D models according to the user's body size and shape. It is an "artificial intelligence tool that uses computer vision and machine learning to analyze images and videos." These models form virtual avatars, making them look and feel authentic [13]. Three.js technology is utilized for Model Handling. Three.js takes care of the generated 3D model's handling [14]. Given the right logic, it will allow users to try on the clothes on the model and even manage the fit of the clothes according to the size of the clothing item.

The measurements required from the user are depicted in Table 1.

Table 1. User measurements required to generate 3D model.

| Measurements        | Explanation                                                                                             |
|---------------------|---------------------------------------------------------------------------------------------------------|
| Waist Circumference | The measurement around the narrowest part of the waist, typically used to determine pant or skirt size. |

|                          |                                                                                                                     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------|
| Hip Circumference        | The measurement around the widest part of the hips, essential for sizing bottoms and dresses.                       |
| Inseam Length            | The distance from the crotch seam to the bottom of the pant leg, indicating the length of trousers or jeans.        |
| Out seam Length          | The measurement from the waistband to the bottom of the pant leg, specifying the full length of pants or skirts.    |
| Thigh Circumference      | The measurement around the widest part of the thigh, crucial for selecting well-fitting bottoms.                    |
| Knee Circumference       | The measurement around the knee, useful for designing pants or selecting knee-high garments.                        |
| Calf Circumference       | The measurement around the widest part of the calf, vital for choosing boots or calf-fitted clothing.               |
| LegOpening Circumference | The measurement around the bottom hem of a pant leg, indicating the width of the leg opening for trousers or jeans. |

By integrating these technologies, a platform that redefines the virtual shopping experience can be created, combining both technical expertise and a well-structured approach.

#### 4. Results

Upon visiting the shopping platform, the customers will be presented with the interface shown in Fig. 3. This user-friendly interface allows customers to navigate to a wide array of clothing designs through the explore more option.



Fig. 3. Initial User interface

Upon selecting a clothing item in the store, the user will be shown a detailed view of the clothing item, which includes the age category of the item, price, ratings and reviews and a detailed image as shown in Fig. 4.

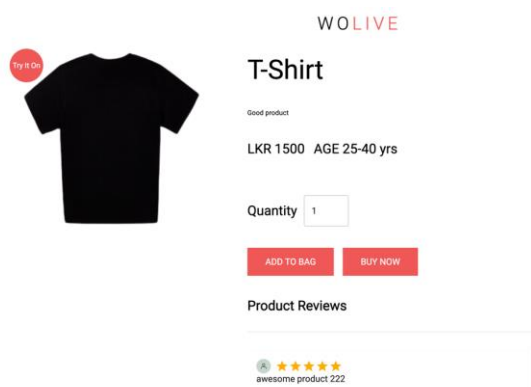


Fig. 4. Detailed item view.

The try it on option shown in Fig. 3 will direct the user to a virtual fitting room where the clothes can be tried on in a 3D model representing their figure. Users will be asked to provide the measurements shown in Table. 1 and a 3-dimensional model will be generated based on the gender of the current customer. The unique feature of this virtual fitting room as mentioned in the initial section of the paper, is the ability to portray the ‘fit’ of the clothing item. Fig. 5 and Fig. 6 will demonstrate this concept.

In Fig. 5, featuring a user model with a waist measurement of 120cm and a height of 183cm, the T-shirt exhibits a somewhat snug fit around the waist area, suggesting a closer and more fitted appearance. Conversely, in Fig. 6, showcasing a user model with a waist measurement of 70cm and the same height, the T-shirt appears to have a slightly looser fit, indicative of a more relaxed and roomier attire for the user.

Similarly, users can assess how the clothing item will look and fit on themselves using the try it on feature of the application.

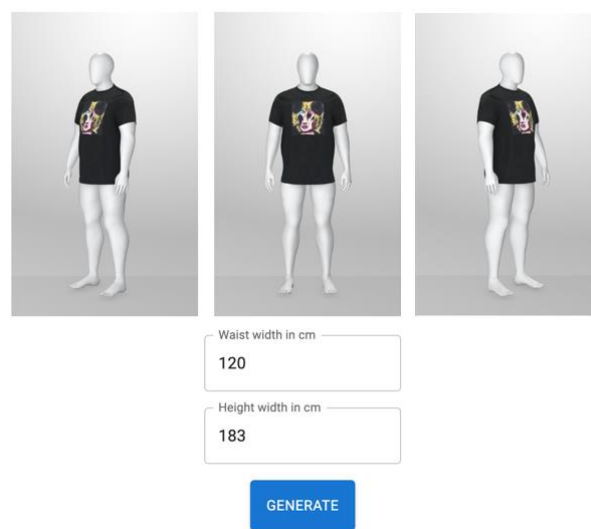


Fig. 5. User Model 1

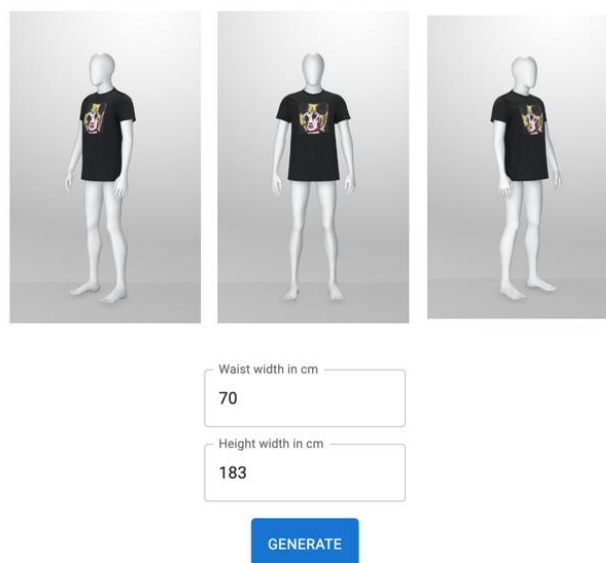


Fig. 6. User Model 2

Once satisfied with the looks of the clothing item, customers can add their item to the shopping cart and checkout securely using the payment gateway. Additionally, the system also allows customers to view all their orders placed

with the corresponding statuses of each order. Once completed customers will be allowed to leave a rating and review the items in the order.

Site administrators can handle the inventory to add new items to the store, update any details of the existing clothing items and remove any out-of-stock items. Order status will also be managed by the site administrators. Overall, the solution developed provides a smooth and user-friendly experience for customers throughout their online shopping journey.

The primary objective of providing an interactive shopping platform was met with the development of this solution. The main sub-objective was aimed at establishing an interactive virtual fitting room within the web application. This objective was achieved through the integration of modern technologies, including React JS, Firebase, Leonardo AI, and 3JS, as discussed in the methodology section. Users were able to create personalized 3D avatars based on their precise body measurements, serving as virtual models for trying on clothing items. The successful implementation of this sub-objective enhanced the user experience.

Secondly, the system developed also effectively addressed the challenge of sizing assessments, as outlined in the second sub-objective. Users had the capability to visualize how various clothing sizes adhered to their 3D avatars, simulating the actual fit and appearance of each item. This feature significantly assisted users in making informed decisions about size selection. By accurately representing the fit of different sizes, the sub-objective was successfully met once again enhancing the overall shopping experience.

Efficiency in the shopping process was a key focus, aligning with Sub-Objective 3. The simple and user-friendly interfaces, secure payment processes and the virtual fitting room streamlined the clothing evaluation process. This resulted in a reduction in time wastage and minimized the need for multiple purchases and returns. As a result, the sub-objective successfully addressed the challenges associated with traditional online shopping.

One of the critical sub-objectives was to boost user confidence in online shopping. By providing users with an accurate visual representation of how clothing items would fit and look on their 3D avatars. Users gained trust in the system's ability to offer reliable sizing and fit information, enhancing their overall confidence in making online clothing selections.

The combination of these sub-objectives collectively contributed to the accomplishment of the primary objective: enhancing the online shopping experience by redefining the way users assess the fit of clothes. Through an interactive virtual fitting room, efficient sizing assessments, reduced time wastage, and enhanced user confidence, the solution developed successfully addressed the challenges associated with online apparel shopping, ultimately offering a more engaging and informed shopping experience.

## 5. Conclusion

The retail industry has undergone a significant transformation in recent times, with a profound shift towards online shopping. This evolution has increased convenience and accessibility for consumers worldwide. However, it has also brought forth a unique set of challenges, particularly concerning the fit and sizing of clothing items. Shoppers found themselves filled with uncertainties regarding the fit, leading to frequent returns, added costs, and a potential erosion of trust in online retail.

In response to these challenges, Wolive platform was developed to redefine the online shopping experience. The primary objective was to provide users with a means to confidently assess the fit of clothing items in a virtual environment. An interactive virtual fitting room was introduced within the web application, backed by cutting-edge Artificial Intelligence technologies. The efficiency of this system will significantly reduce time wastage, while the accuracy of visual representations will boost user confidence.

The solution not only embraces the digital age but also fosters a sense of trust and reliability. Therefore, Wolive platform sets a new standard for the online shopping experience by making online apparel shopping as seamless and satisfying as the traditional brick-and-mortar experience.

In conclusion, the recent shift towards online shopping brought its share of issues, but it also presented an opportunity for innovation. Wolive solution has risen to the occasion, offering users a reliable and engaging way to assess clothing fit, thus safeguarding against the pitfalls of online apparel shopping, and steering us towards a more confident and sustainable retail future. However, there is still room for improvement in the future to make the online shopping experience even more realistic. Wolive platform gives customers a good idea on the fit of the clothes, however customer will not be able to feel the texture of the clothing material. Future research can explore more immersive AR and VR experiences within virtual fitting rooms. This could involve the use of AR glasses or VR headsets to create a highly realistic and interactive environment where users can not only see how clothes fit but also feel the fabrics and textures virtually.

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