IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 1, January 2026

DOI: 10.17148/IJARCCE.2026.151133

HERFIT: A REAL-TIME VIRTUAL DRESSING FOR WOMEN

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Abstract: Online apparel shopping has become increasingly popular, but customers still face difficulties in visualizing how clothes will look and fit on their bodies before purchasing. Static product images and size charts fail to provide a realistic understanding of garment appearance, often leading to dissatisfaction and high return rates. This limitation highlights the need for an interactive and personalized virtual try-on solution.

This paper presents **HerFit**, a **real-time virtual dressing system** that allows users to try on garments virtually using live webcam input. The system detects the user's body posture using computer vision techniques and overlays selected clothing items onto the user's live video feed. By dynamically aligning garments with body landmarks, HerFit provides a realistic and interactive dressing experience without the need for physical trials.

Unlike conventional virtual fitting approaches that depend on static images or predefined models, HerFit adapts to user movement and posture changes. This interactive approach allows users to visualize clothing more accurately and make informed purchase decisions. The proposed system enhances user confidence, improves overall shopping experience, and demonstrates the effective use of real-time computer vision technologies in modern fashion e-commerce platforms.

The system is implemented using React for the frontend, Flask for backend processing, MediaPipe and OpenCV for pose detection and image processing, and MySQL for data storage. The project demonstrates effective integration of web technologies and computer vision to create a user-friendly and efficient virtual try-on solution. HerFit aims to enhance user confidence in online shopping and reduce uncertainty related to clothing selection.

I. INTRODUCTION

The rapid growth of e-commerce has significantly transformed the fashion retail industry by enabling users to shop for clothing online from anywhere. Despite this convenience, online apparel shopping still lacks one essential aspect of the ability to physically try on clothes before purchasing. This limitation often results in uncertainty regarding fit, appearance, and comfort, leading to increased product returns.

Traditional online platforms rely on static images, mannequins, or generic size charts that do not accurately reflect individual body shapes and proportions. Such methods provide limited personalization and fail to capture real-time body movements, reducing user confidence in purchase decisions.[1]

Advancements in computer vision and real-time image processing have opened new possibilities for virtual try-on systems. These systems aim to simulate the physical dressing experience by overlaying garments on a user's body using live camera input.

HerFit is developed to address these challenges by providing a real-time virtual dressing solution that allows users to visualize clothing on their own bodies. The system enhances the online shopping experience by offering an interactive and personalized apparel visualization platform.

1.1 Project Description

HerFit is a real-time virtual dressing system developed to digitally replicate the experience of trying on clothes in an online environment. The system allows users to create an account, log in securely, and explore a variety of clothing categories such as frocks, kurtas, gowns, and tops. After selecting a desired garment, users can activate the virtual try-on feature, which uses a live webcam feed to display how the outfit appears on their body in real time. The core functionality of HerFit is built using computer vision and pose detection techniques. The system detects key body

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landmarks, including the shoulders, torso, and waist, to understand the user's posture and body structure. Based on these detected points, the selected garment image is dynamically resized and aligned to fit the user's body accurately. This real-time adjustment ensures that the garment moves naturally with the user, providing a realistic and interactive dressing experience.

In addition to visualization, HerFit includes a snapshot feature that allows users to capture images of their virtual try-on sessions. These snapshots are stored securely and can be accessed later through a personalized dashboard for review or comparison. The application also provides profile management features, enabling users to view and manage their personal information.Overall, HerFit offers a user-friendly and efficient solution that enhances online apparel shopping by improving visualization accuracy, increasing user confidence, and reducing uncertainty in garment selection.

1.2 Motivation

One of the most significant challenges in online apparel shopping is the lack of confidence customers experience when purchasing clothing without physically trying it on. Unlike in-store shopping, online platforms do not allow users to assess how a garment fits their body shape, posture, or overall appearance. This uncertainty often leads to incorrect size selection and dissatisfaction after purchase, resulting in frequent product returns. High return rates not only inconvenience customers but also cause financial and logistical issues for retailers.

Although several virtual try-on solutions have been proposed, many existing systems depend on specialized hardware such as depth sensors or require high computational resources. Some approaches rely on preprocessed images or static models, limiting their ability to support real-time interaction. These constraints make such systems difficult to deploy widely and unsuitable for everyday users who rely on standard consumer devices.

The motivation behind the HerFit project is to address these limitations by developing a lightweight, accessible, and real-time virtual dressing system. HerFit is designed to work efficiently using a standard webcam and commonly available hardware, eliminating the need for expensive equipment. By providing realistic garment visualization through live video input, the system aims to improve user confidence during online shopping. Ultimately, HerFit seeks to enhance customer satisfaction, reduce return rates, and support more informed purchasing decisions in online fashion platforms.

II. RELATED WORK

Virtual try-on systems have been widely studied as a solution to improve online apparel shopping experiences. Early research in this area focused on image-based methods, where clothing items were overlaid onto static images of users or mannequins. While these approaches provided basic visualization, they lacked realism and did not account for individual body posture or movement, limiting their effectiveness.

With advancements in computer vision, pose estimation techniques were introduced to enhance garment alignment. Frameworks such as OpenPose and MediaPipe enabled the detection of key body landmarks, allowing garments to be positioned more accurately on the human body. Image-based virtual try-on models like VITON and CP-VTON further improved garment warping and preservation of clothing characteristics. However, these models were primarily designed for static images and required significant computational resources.

Recent studies have explored lightweight and real-time virtual try-on solutions, but many still rely on specialized hardware or preprocessed inputs, reducing accessibility for everyday users. Additionally, some systems do not support continuous live interaction, which is essential for a realistic dressing experience.

HerFit builds upon existing research by offering a real-time, webcam-based virtual dressing system that dynamically adapts to user movement. By focusing on lightweight implementation and real-time interaction, HerFit addresses the limitations of previous approaches and enhances usability in online fashion platforms.

III. METHODOLOGY

The HerFit system captures live video input from the user's webcam to enable real-time virtual try-on. Pose detection techniques are applied to identify key body landmarks such as shoulders and torso. Based on these landmarks, the selected garment is dynamically resized and aligned with the user's body. The garment overlay updates continuously to

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match user movement and posture. Users can capture snapshots of the try-on results for later review. This methodology ensures smooth interaction and realistic apparel visualization.

3.1 SYSTEM ARCHITECTURE AND DATA FLOW

The HerFit system follows a modular architecture that separates user interaction, video input, pose detection, garment processing, and output visualization. The frontend handles user login, garment selection, and display, while the backend manages pose detection and garment alignment. Live webcam input is processed to detect body landmarks, which are used to overlay garments accurately. This layered design improves system maintainability and real-time performance.

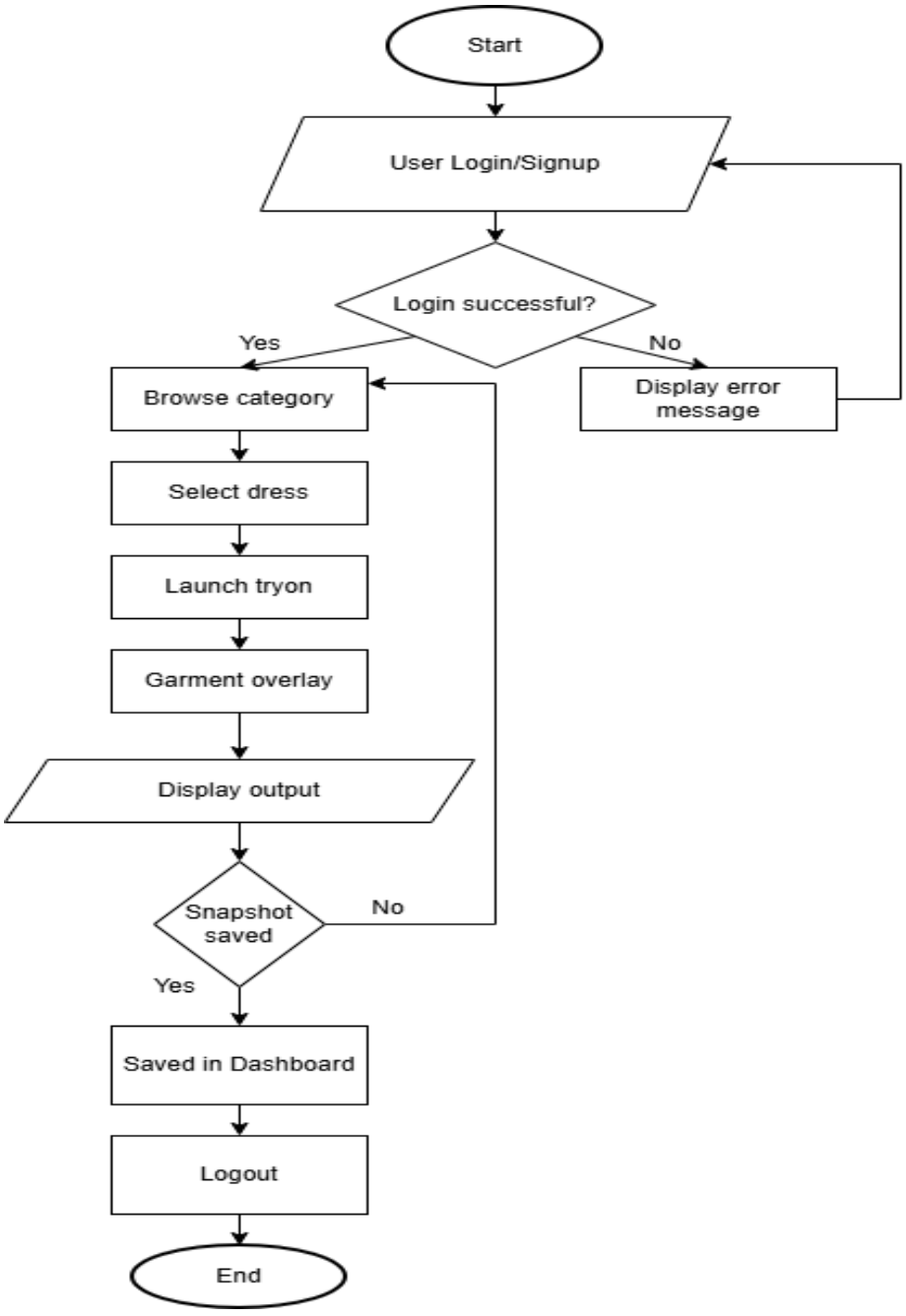

Fig. 1. Flowchart of methodology

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3.2. POSE DETECTION AND BODY LANDMARK IDENTIFICATION

The HerFit system captures live video input from the user's webcam to analyze body posture in real time. Pose detection techniques are applied to identify key body landmarks such as shoulders, torso, arms, and hips. These landmarks act as reference points for understanding the user's body structure and posture. Accurate detection of body points helps the system determine the correct position and size for garment placement. The pose detection process runs continuously to track user movement. This ensures that the virtual try-on remains stable and responsive during the session.

3.3 GARMENT OVERLAY PROCESS

Once the user selects a garment, the system processes the clothing image and resizes it based on detected body landmarks. The garment is positioned accurately over the user's body by aligning it with key reference points such as shoulders and torso. The overlay process is performed in real time, allowing the garment to move naturally with the user. As the user changes posture or position, the overlay adjusts automatically. This dynamic alignment enhances realism and improves the overall virtual dressing experience.

3.4 IMPLEMENTATION FLOW

1. The user logs into the system or creates a new account to access personalized features of the HerFit application.
2. The user explores different clothing categories available in the system to choose a preferred type of garment.
3. The user selects a specific dress from the chosen category to proceed with the virtual try-on process.
4. The system activates the webcam to capture live video input for real-time body detection.
5. The system analyzes the live video feed to detect the user's body posture and key body landmarks.
6. The selected garment is dynamically aligned and overlaid on the user's body in real time.
7. The user can capture a snapshot of the virtual try-on result for future reference.
8. The captured snapshot is securely stored and displayed in the user's dashboard for later viewing.

IV. SIMULATION AND EVALUATION FRAMEWORK

A. EXPERIMENTAL SETUP AND ENVIRONMENT

The simulation of the HerFit Real-Time Virtual Dressing System was conducted in a controlled computational environment to evaluate real-time pose detection and garment overlay performance. The system was developed using **Python 3.10** and integrated with the MediaPipe Pose framework for efficient body landmark detection. The experimental setup used a standard laptop with an Intel i5 processor and 8GB RAM, without relying on high-end GPUs, to demonstrate system accessibility. The software pipeline included webcam activation, real-time video frame acquisition, pose landmark extraction, and garment rendering. This setup ensured that the system could operate smoothly under real-world conditions using commonly available hardware.

B. POSE DETECTION AND GARMENT OVERLAY PROCESS

For evaluation, the system focused on real-time pose detection and garment alignment using live webcam input. Key body landmarks such as shoulders, torso, and hips were continuously extracted from each video frame. These landmarks served as reference points for resizing and positioning the selected garment image. The garment overlay process dynamically adjusted the clothing alignment as the user changed posture or movement. This approach ensured stable visualization without requiring preprocessed datasets or offline training. The evaluation verified the system's ability to maintain accurate alignment during continuous user interaction.

C. OUTPUT ANALYSIS AND UI VALIDATION

The system processes each webcam video frame and extracts 33 body keypoints using MediaPipe Pose. Key landmarks such as the left and right shoulders and torso region are used for accurate garment scaling and alignment. Continuous frame processing ensures smooth garment overlay during user movement. User interface validation confirmed seamless navigation and stable real-time visualization.

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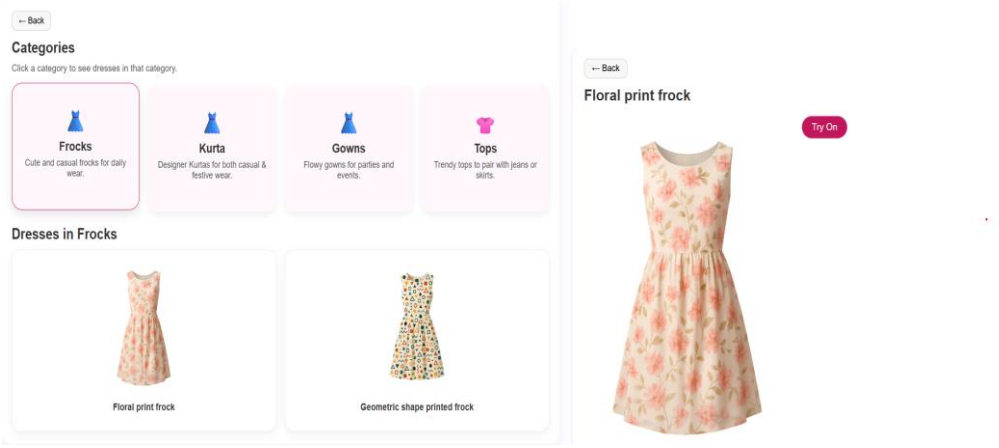

Fig 2: Dress Listing and Dress Detail Page

This page displays all dresses belonging to the selected category with images. Users can browse and choose a dress for virtual try-on. This page shows the selected dress in detail along with a Try-On button. It allows users to proceed with the virtual fitting process.

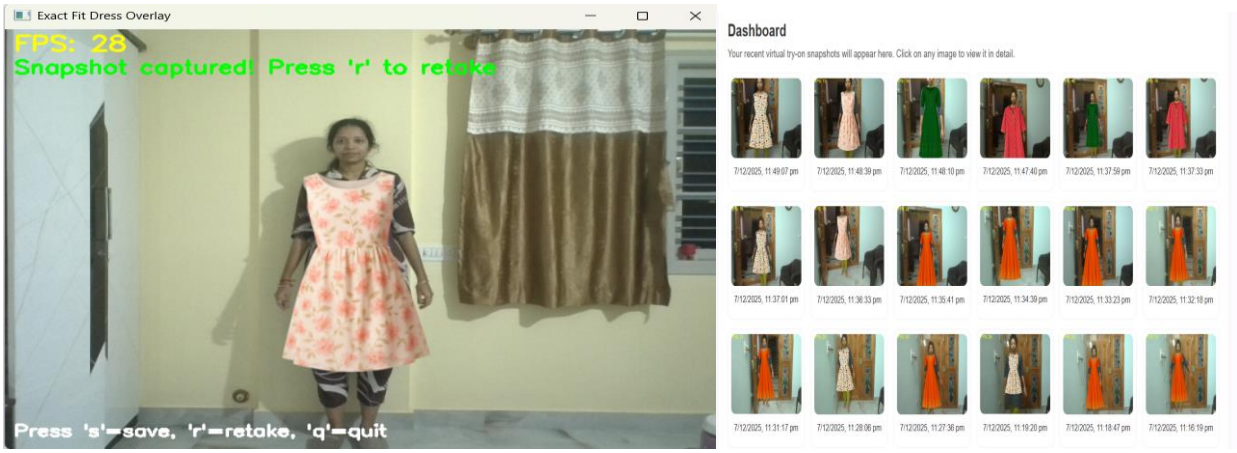

Fig 3 : garment overlay and dashboard display

The system activates the webcam and detects the user's body pose in real time. The selected dress is aligned and overlaid on the user's body.

V. RESULTS AND DISCUSSION

The HerFit real-time virtual dressing system was evaluated through multiple live try-on sessions to analyze its performance, accuracy, and overall user experience. The system successfully processed live webcam input and overlaid selected garments onto the user's body in real time. Pose detection consistently identified key body landmarks such as the shoulders, torso, and hips, which enabled accurate scaling and positioning of garments during the virtual try-on process.

The garment overlay remained stable across continuous video frames, ensuring smooth visualization even when the user changed posture or made moderate movements. The real-time frame-by-frame processing allowed the system to update garment alignment dynamically, resulting in a natural and realistic try-on experience. Compared to static image-based visualization methods, HerFit provided significantly better interaction and realism.

System responsiveness was observed to be satisfactory, with minimal latency during live video processing. The application performed efficiently on standard consumer-grade hardware without the need for specialized GPUs, demonstrating its accessibility and practicality for real-world deployment. Pose detection accuracy remained reliable under normal indoor lighting conditions and uncluttered backgrounds.

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From a usability perspective, the user interface was found to be intuitive and easy to navigate. Users could smoothly move through login, garment selection, virtual try-on activation, and snapshot capture without confusion. The snapshot feature proved especially useful, as it allowed users to save and compare different outfit options, supporting informed decision-making.

Overall, the results indicate that HerFit effectively enhances online apparel shopping by providing realistic visualization and interactive user engagement. The discussion highlights that the system successfully addresses common challenges such as poor fit estimation and limited visualization, thereby improving user confidence and satisfaction in online fashion platforms.

VI. CONCLUSION

This paper presented HerFit, a real-time virtual dressing system developed to improve the online apparel shopping experience by enabling users to visualize garments on their own bodies. The system addresses one of the major limitations of e-commerce fashion platforms—the inability to physically try on clothing—by providing an interactive and realistic virtual try-on solution using live webcam input.

HerFit integrates computer vision and pose detection techniques to accurately identify key body landmarks such as shoulders and torso. Based on these landmarks, garments are dynamically scaled and aligned in real time, allowing the clothing to adapt naturally to user movement and posture. This approach significantly improves visualization accuracy compared to traditional static images or size charts.

The system was designed with accessibility and usability in mind, operating efficiently on standard consumer hardware without the need for specialized equipment. Features such as user authentication, garment category browsing, real-time try-on, and snapshot storage contribute to a smooth and user-friendly workflow. The evaluation results demonstrate stable performance, minimal latency, and consistent garment alignment during live interaction.

Overall, HerFit enhances user confidence during online shopping, reduces uncertainty in garment selection, and has the potential to lower return rates for retailers. The project demonstrates the practical application of real-time computer vision technologies in fashion e-commerce and highlights the growing importance of virtual dressing solutions in modern digital retail environments.

VII. FUTURE WORK

Although the current implementation of the HerFit virtual dressing system successfully delivers a real-time virtual try-on experience, several enhancements can be implemented to further improve functionality, realism, and user engagement. One important future enhancement is the integration of an intelligent size recommendation module. By analyzing detected body proportions such as shoulder width, torso length, and overall body ratios, the system can suggest appropriate clothing sizes (S, M, L, etc.), helping users make more confident purchase decisions and reducing return rates.

Another major enhancement is the introduction of 3D garment modelling and fabric simulation. Currently, the system uses 2D garment overlays; however, incorporating 3D models can provide more realistic visualization by simulating fabric behaviour such as drape, stretch, and folds. This improvement would allow users to better understand how a garment behaves in real-life scenarios.

The system can also be expanded to support **virtual try-on for accessories** such as jewellery, sunglasses, shoes, and handbags. By extending pose detection to face and foot landmarks, HerFit can offer a complete virtual styling experience beyond clothing alone. Additionally, implementing **gender-specific modules** for male and female users can improve garment relevance and accuracy.

Future work may also focus on **mobile application development**, enabling users to access HerFit on smartphones and tablets. Enhancing system robustness under varying lighting conditions and complex backgrounds will further improve usability. Finally, integrating AI-based personalization and recommendation features can help tailor outfit suggestions based on user preferences and previous try-on history. These enhancements will make HerFit a more scalable, intelligent, and comprehensive solution for next-generation online fashion platforms.

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