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Swooshfit : Virtual Try on of Shoes in Augmented Reality on a Mobile Device

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Abstract -SwooshFit is a Virtual Try-On of Shoes in Augmented Reality on a Mobile Device. The integration of augmented reality (AR) in e-commerce has transformed the way users interact with products online. SwooshFit is a virtual try-on system that enhances the online shoe shopping experience by enabling real-time visualization of footwear on mobile devices. By leveraging advanced AR techniques, the system ensures accurate placement and realistic rendering, offering an immersive and interactive shopping experience.With a focus on performance and precision, SwooshFit optimizes rendering speeds and minimizes errors, delivering smooth and responsive functionality. The system outperforms existing solutions in terms of efficiency and accuracy, making virtual try-ons more accessible and reliable. Future advancements will explore AI-driven personalization and expanded AR capabilities, further bridging the gap between digital and physical retail.

Key Words: Augmented Reality, Virtual Try-On, Shoe Shopping, E-Commerce.

1. INTRODUCTION

The evolution of augmented reality (AR) has significantly transformed the online shopping experience, particularly in the fashion and footwear industry. SwooshFit is a virtual try-on system designed to enhance digital shoe shopping by allowing users to visualize footwear in real time on their mobile devices. By leveraging AR technology, the system bridges the gap between traditional retail and e-commerce, offering a more interactive and immersive shopping experience.

As online shopping continues to grow, customers often face challenges in selecting the right footwear due to the inability to physically try them on. SwooshFit addresses this issue by providing a realistic and accurate visualization of shoes, enabling users to make more informed purchasing decisions. The system focuses on optimizing rendering accuracy and reducing lag, ensuring smooth real-time interactions.

Beyond just visualization, the platform enhances user engagement by integrating high-performance AR rendering techniques. With seamless compatibility across various mobile devices, SwooshFit ensures accessibility for a broad range of users. As technology advances, future developments will further refine personalization and interactivity, making virtual try-ons an integral part of online shopping.

By combining innovation with user convenience, SwooshFit redefines the footwear shopping experience, improving customer satisfaction and bridging the gap between digital and physical retail.

2. LITERATURE REVIEW

[1] Augmented Reality in E-Commerce: Enhancing the Online Shopping Experience – This review by Chen and Williams explores the impact of augmented reality (AR) on e-commerce, focusing on how AR enhances product visualization, consumer engagement, and purchasing decisions. The study examines various AR implementations across different retail sectors, highlighting their effectiveness in improving user confidence and reducing return rates. The authors analyze case studies of successful AR applications in fashion and footwear, emphasizing the growing demand for interactive shopping experiences. The review also discusses the limitations of AR adoption, including technological constraints and consumer adaptation challenges, while proposing future directions for improving AR-based online shopping platforms.

[2] Virtual Try-On Technologies: A Comparative Analysis of AR and AI-Based Solutions – This paper by Patel and Robinson investigates the development of virtual try-on technologies, comparing AR-based approaches with AI-driven solutions in retail. The authors analyze the advantages of real-time AR visualization for fashion and footwear, contrasting them with AI-powered image-based fitting techniques. The study reviews multiple virtual try-on systems, assessing factors such as realism, usability, and computational efficiency. Findings suggest that AR-based try-on solutions provide superior interactive experiences, while AI-based approaches excel in predictive fitting. The paper highlights the need for hybrid models that integrate both technologies for enhanced accuracy and user satisfaction.

[3] Real-Time Object Tracking for Augmented Reality Applications – In this study, Kim and Zhao examine the role of real-time object tracking in AR applications, focusing on its significance in virtual try-on systems. The authors discuss various tracking methods, including marker-based, markerless, and deep learning-driven tracking techniques, evaluating their accuracy and computational efficiency. The paper highlights challenges such as occlusion handling, lighting variations, and device compatibility, proposing optimization strategies to improve tracking performance. The findings suggest that enhanced real-time tracking can significantly improve the accuracy and realism of AR-based virtual try-on experiences, making them more practical for e-commerce applications.

[4] User Experience and Interface Design for AR Shopping Applications – This paper by Singh and Martinez explores the design principles for AR-based shopping applications, emphasizing usability and user engagement. The study examines the impact of interface elements such as gesture-based interactions, 3D visualization, and customization options on user experience. Through usability testing and consumer feedback analysis, the authors identify best practices for

creating intuitive and accessible AR shopping interfaces. The research concludes that well-designed AR applications enhance consumer trust, improve engagement, and encourage higher conversion rates, highlighting the importance of seamless UI/UX integration in virtual try-on systems.

[5] Performance Optimization in Mobile Augmented Reality Systems – Johnson and Lee analyze performance optimization techniques for AR applications on mobile devices, focusing on rendering speed, battery consumption, and real-time processing efficiency. The study reviews various optimization strategies, including frame rate enhancements, memory management techniques, and hardware acceleration methods. The findings indicate that achieving high-performance AR rendering on mainstream mobile devices requires a balance between computational efficiency and visual fidelity. The paper provides insights into how developers can optimize AR applications to deliver smooth and responsive virtual try-on experiences while maintaining device performance.

[6] The Role of Artificial Intelligence in Enhancing AR Shopping Experiences – In this study, Brown and Gupta explore the integration of artificial intelligence (AI) with AR technology in e-commerce applications. The authors analyze AI-driven personalization techniques, real-time recommendation systems, and automated object recognition methods that enhance virtual try-on solutions. The paper highlights how AI can improve AR precision, reduce classification errors, and tailor shopping experiences based on user preferences. Findings suggest that AI-AR integration leads to higher user satisfaction and engagement, paving the way for more intelligent and adaptive virtual try-on applications.

[7] Consumer Perception of AR-Based Virtual Try-On Solutions – This paper by Williams and Carter examines consumer attitudes toward AR-based virtual try-on experiences in online shopping. Through surveys and behavioral analysis, the study assesses factors influencing user adoption, including ease of use, perceived accuracy, and trust in AR-generated visuals. The authors discuss the psychological impact of interactive shopping and its influence on purchasing decisions. The research concludes that AR try-ons significantly improve consumer confidence, reduce return rates, and enhance overall satisfaction, reinforcing the potential of AR technology in the e-commerce sector.

[8] Future Trends in Augmented Reality for Online Shopping – In this review, Green and Taylor explore emerging trends in AR for e-commerce, predicting advancements in hardware capabilities, AI integration, and cross-platform compatibility. The study examines upcoming developments such as AR glasses, haptic feedback systems, and cloud-based rendering solutions, assessing their potential impact on virtual try-on applications. The authors argue that the future of AR shopping will be shaped by improvements in realism, interactivity, and personalization, leading to more immersive and efficient digital retail experiences.

3. PROBLEM STATEMENT

With the increasing shift toward online shopping, consumers face significant challenges in selecting footwear without the ability to try them on physically. Traditional e-commerce platforms often rely on static images and size charts, which can lead to uncertainty, improper fit, and higher return rates. This gap between digital shopping and in-store experiences results in reduced consumer confidence and satisfaction.

SwooshFit aims to address this issue by introducing an AR-based virtual try-on system that allows users to visualize shoes in real-time on their mobile devices. However, despite the advancements in augmented reality, challenges such as rendering accuracy, real-time tracking, and seamless user interaction remain. Additionally, ensuring accessibility across various devices and optimizing performance for a smooth user experience are critical concerns.This project seeks to identify and overcome these limitations by refining the AR technology used in SwooshFit, improving its accuracy, usability, and compatibility. By enhancing the virtual try-on experience, the goal is to bridge the gap between online and in-store shopping, ultimately providing consumers with a more interactive, reliable, and satisfying shopping journey.

4. PROPOSED SYSTEM

Our proposed system, SwooshFit, is designed to revolutionize the online footwear shopping experience by integrating Augmented Reality (AR) and 3D visualization. Traditional online shopping lacks the ability for customers to physically try on shoes, leading to uncertainty in fit and style. SwooshFit bridges this gap by enabling users to visualize and interact with shoes in real-time before making a purchase .The platform is built using React.js for the front end and Supabase for the backend, ensuring scalability, real-time updates, and efficient data management. It is optimized for mobile performance, leveraging ARKit and ARCore to provide precise tracking, realistic rendering, and seamless user interaction.

This section presents a detailed overview of SwooshFit, outlining its key modules:

1. User Interface (UI) Module: This module provides a clean, user-friendly interface, ensuring seamless navigation and interaction. The UI is designed with a modern, minimalistic layout that allows users to Browse the shoe catalog with filters (brand, color, size, price).Easily access the virtual try-on and 3D preview features .Save favorite shoes for future reference.

2. Shoe Detection and Classification Module: This module utilizes computer vision algorithms to: Detect the user's feet in real-time using their smartphone camera. Classify and match the selected shoe model to the foot's position. Estimate and recover the 6-DoF (degrees of freedom) pose, ensuring accurate placement within the AR environment.

3. Virtual Try-On (AR) Module: This core module enables users to Try on shoes virtually using Augmented Reality. Rotate, zoom, and inspect shoes from different angles. See how the shoe fits in real-time before purchasing.

4. 3D Visualization Module: For users who prefer a detailed preview, this module provides 360-degree rotation and zoom-in capabilities. Detailed texture rendering to inspect shoe material and stitching. Multiple colorway previews without needing AR mode.

5. AR Testing and Deployment Module: To ensure cross-platform compatibility, this module focuses on Deployment using ARKit and ARCore. Compatibility with various smartphone models and screen sizes. Continuous testing and updates for stability and accuracy.

6. The Public Collection System (SPCS) module: streamlines the donation of pre-owned athletic gear through an app-based platform, integrating smart drop boxes and collection hubs for convenient recycling and redistribution.

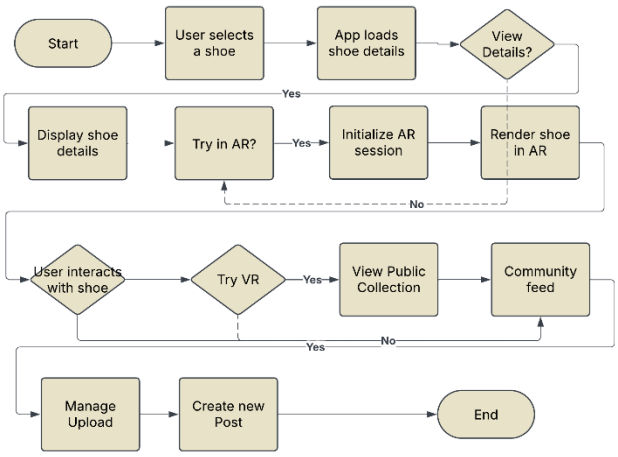

Fig 1: Activity Diagram

RESULTS AND DISCUSSION

The Users interact with SwooshFit through a web-based interface developed using React.js for the front end and Supabase as the backend database. The system provides an interactive AR-based virtual try-on experience, enabling users to visualize shoes in real time before making a purchase.

The interface offers several primary options: Browse Shoes, Try On, View Cart, and Purchase. Users can select a shoe model from the catalog, activate the AR try-on feature, and see the virtual shoe overlaid on their feet. The system leverages real-time pose estimation and 3D rendering to ensure accurate visualization. Once the user finds a suitable pair, they can add it to their cart and proceed with the purchase through integrated e-commerce platforms. Personalized recommendations based on browsing history enhance user engagement, while real-time performance optimization ensures smooth AR interactions across different devices.The Home Page of SwooshFit allows users to browse shoes and access the AR try-on feature, providing a seamless and immersive shopping experience.

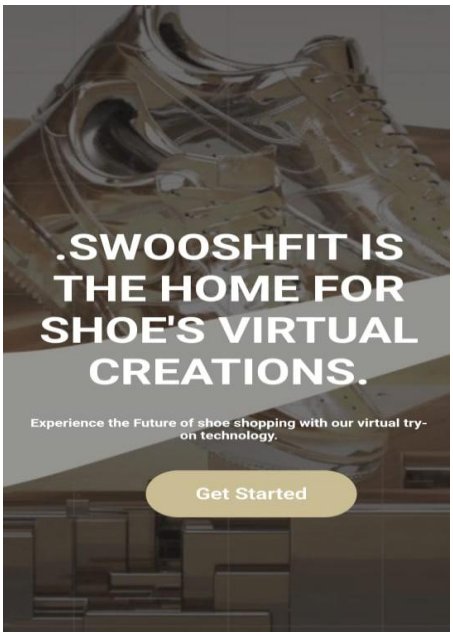

Fig 2: Home Page

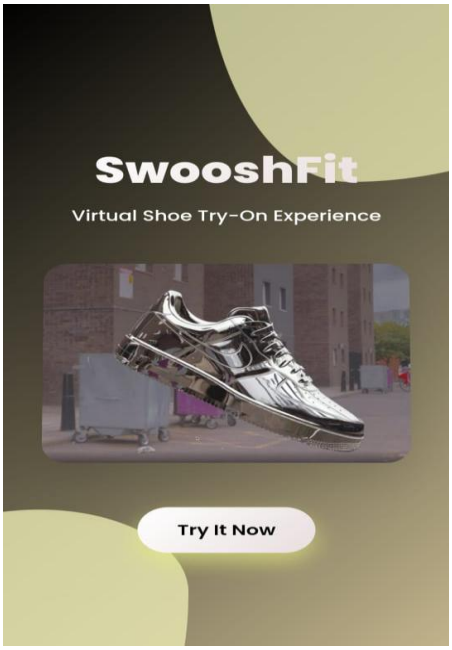

Fig 3: Landing page

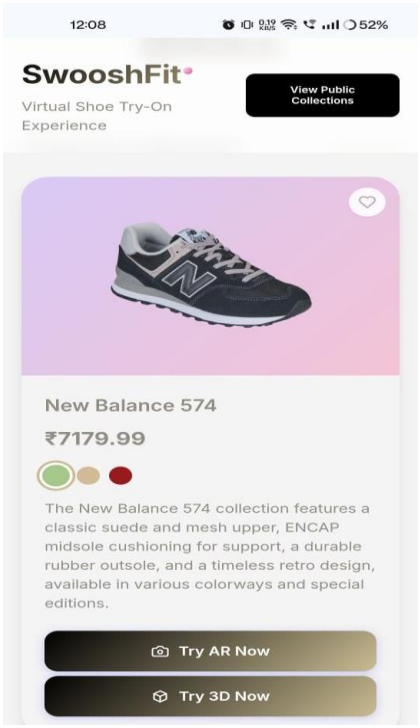

Fig 4: Try-on Page

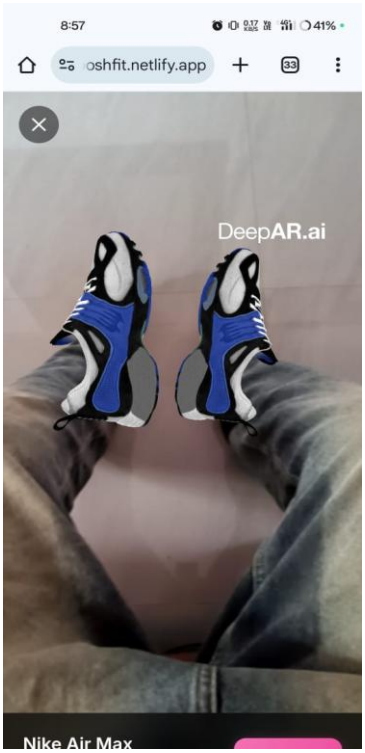

Fig 6: Try on AR page

Fig 5: Try 3D Page

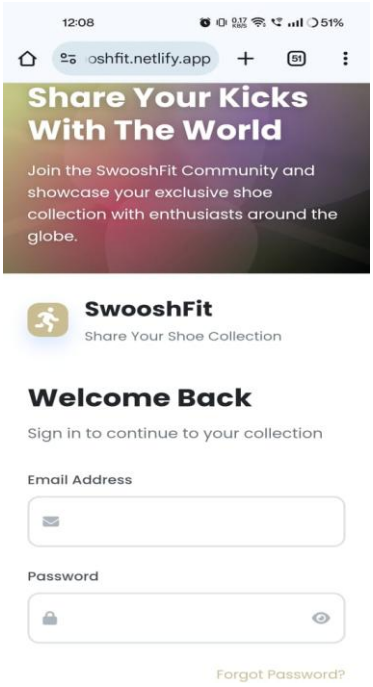

Fig 7: Public collection page

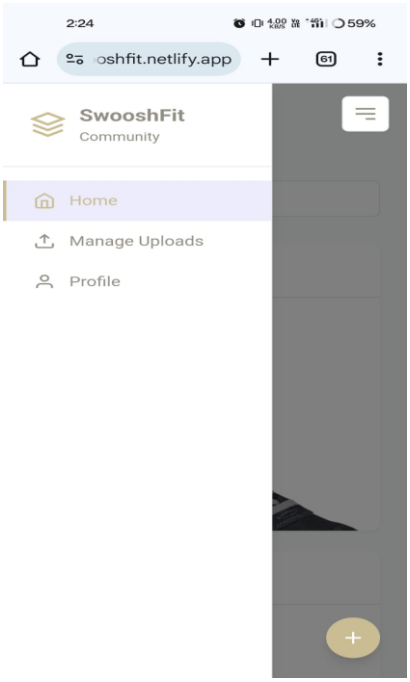

Fig 8: Community Feed

6. CONCLUSION

The SwooshFit - Virtual Try-On System was developed to revolutionize the online footwear shopping experience by integrating augmented reality (AR) for real-time visualization. By enabling users to try on shoes virtually before purchasing, the system enhances consumer confidence, reduces return rates, and bridges the gap between traditional retail and e-commerce. With features such as real-time shoe detection, 3D model rendering, and performance optimization, SwooshFit provides a seamless and interactive experience. The system's user-friendly interface, coupled with high-performance AR tracking, ensures accessibility across various mobile devices.

Future enhancements include AI-driven personalization, expanded shoe databases, and integration with major e-commerce platforms, making SwooshFit an essential tool in the evolution of digital retail. Ultimately, SwooshFit redefines footwear shopping by offering an immersive, accurate, and engaging virtual try-on experience, empowering users to make informed purchasing decisions with ease.

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