WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Real-Time Virtual Try-On System for Clothing Using 3D Models and Pose Estimation in Android

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A B S T R A C T:

Recently, virtual try-on systems have become increasingly popular, driven by advancements in augmented reality and computer vision. This paper showcases a real-time virtual try-on solution designed for Android devices, which integrates 3D clothing models with pose estimation to deliver a lifelike fitting experience. Users can register, upload their clothing items, and virtually try them on using their mobile cameras. By utilizing Android development alongside Java and XML, and employing pose estimation for proper alignment, this application presents an engaging and user-friendly alternative to conventional shopping methods. This strategy aims to enhance user satisfaction, lower return rates from online purchases, and broaden access to fashion innovations

Keywords: Virtual Try-On, Pose Estimation, Android, Firebase, TensorFlow, Augmented Reality, Full-Body Garments

1. INTRODUCTION:

The fashion and e-commerce sectors are experiencing a shift towards digital solutions aimed at customizing user experiences through innovative technology. Conventional shopping methods are increasingly being supplanted by online options, particularly in the aftermath of the pandemic. A significant hurdle in purchasing clothing online is the challenge of visualizing how items will look on a person in real-time. This study tackles this issue by developing an Android application that incorporates pose estimation and 3D modeling to replicate the try-on experience in real-time. This system is lightweight, mobile-friendly, and offers an engaging way for users to visualize clothing, representing a forward-thinking approach to virtual fitting rooms.

Virtual try-on technologies enable customers to see clothing on digital avatars of themselves, enriching the experience of online shopping. Nonetheless, many current systems concentrate mostly on upper-body apparel and fall short in providing options for full-body fittings. This project suggests an Android application for real-time virtual try-ons that accommodates both upper and lower-body items. It utilizes pose estimation methods to carefully align clothing with the user's posture, resulting in a fluid and realistic fitting experience.

The aim of this initiative is to connect consumers with online clothing options by offering a portable, intuitive, and responsive tool. This is particularly important for minimizing return rates caused by incorrect sizing or visual mismatches, while also fostering a more inclusive and interactive fashion experience.

2. LITERATURE SURVEY:

Current virtual try-on solutions like VITON (Virtual Try-On Network) and CP-VTON (Characteristic Preserving VTON) employ techniques such as image warping and person segmentation to superimpose clothing onto user photos. While these methods are creative, they tend to operate in controlled settings and primarily focus on upper-body attire.

Recent developments also incorporate Generative Adversarial Networks (GANs) to improve the realism of clothing generation. However, many of these models require substantial computational resources, making them impractical for real- time use on mobile devices.

Additionally, existing systems often lack synchronization with cloud databases and provide limited options for users to upload their own garments or adjust poses in real-time. Our research seeks to address these shortcomings by concentrating on:

- Real-time performance on mobile devices
- Compatibility with full-body garments
- Simple garment upload and retrieval through Firebase
- User-friendly interface utilizing Android components

This strategy guarantees that our solution is scalable, accessible, and feasible for deployment on common Android smartphones.

3. METHODOLOGY:

3.1 System Architecture

The system architecture comprises:

- **User Interface:** Built using Android Studio with Java and XML, it features registration, image uploads, and a virtual try-on experience.
- **Pose Estimation Engine:** Utilizes TensorFlow Lite models (MoveNet/BlazePose) to process camera feeds, extracting body keypoints in real time.
- **Garment Mapping Layer:** This component links uploaded clothing items with body keypoints, allowing for the dynamic positioning of garments on the user's image.
- **Firebase Integration:** Employs Firebase Realtime Database and Firebase Storage to securely store user information and clothing images.

3.2 Digital Template Generation

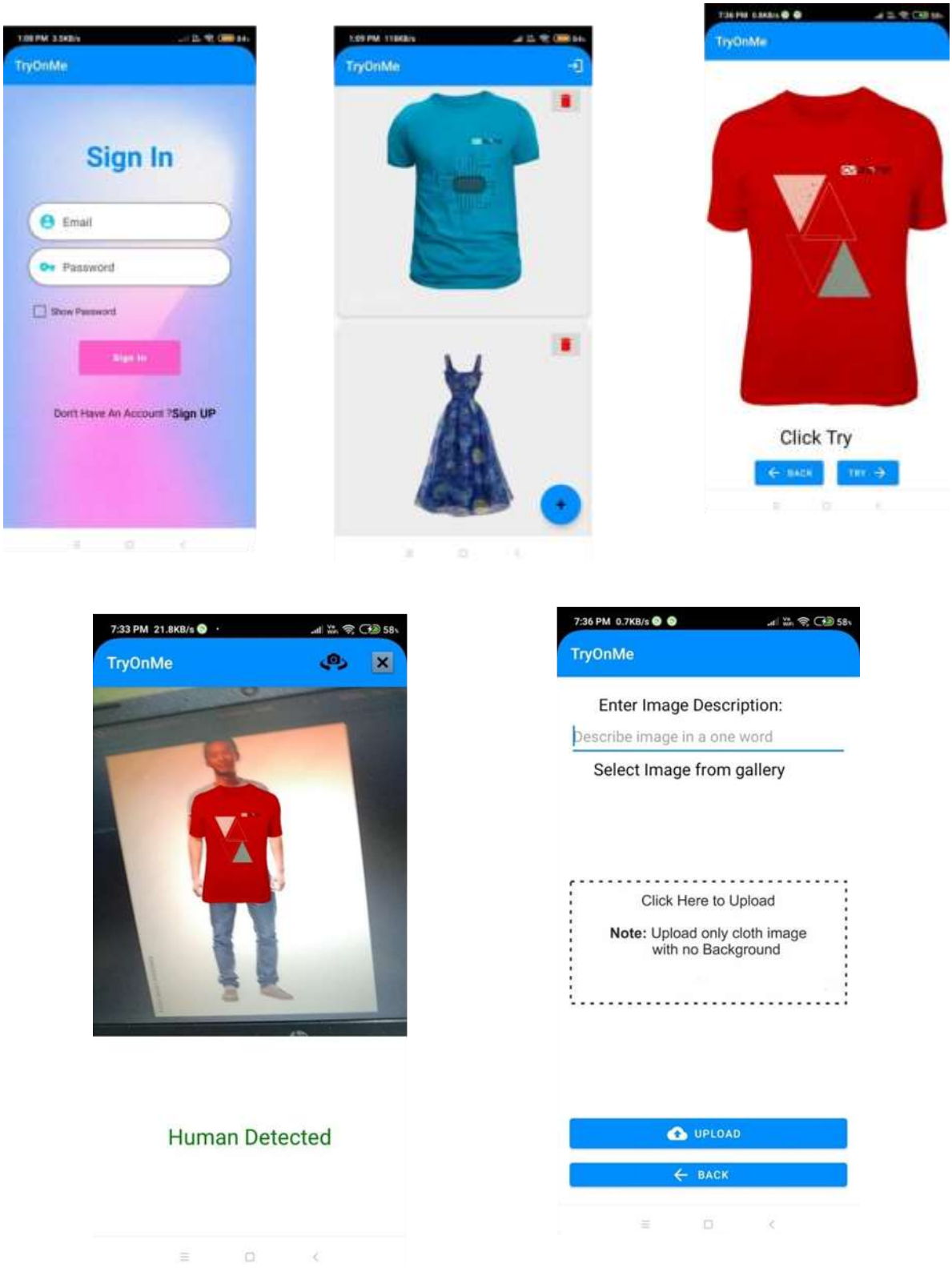
Initially, the system captures pose keypoints from the camera and aligns clothing photos by identifying matching anchor points (e.g., shoulders, hips, knees). This process facilitates the dynamic placement of garments on both the upper and lower body.

3.3 Human Credits Implantation

Human credits implantation is introduced to maintain user individuality during the try-on process. This includes encoding unique user traits and style preferences, allowing for seamless blending and real-time adjustments of clothing overlays. The model continuously adapts to changes in posture and camera angles, producing a dynamic and expressive result.

3.4 Real-Time Rendering

Real-time try-on is enabled through optimized TensorFlow Lite inference, ensuring low latency and high responsiveness.



4. APPLICATIONS:

1. **- E-Commerce:** Customers can visualize clothing prior to buying, enhancing their confidence and minimizing returns.

2. - **Virtual Dressing Rooms:** Retailers can implement this as a contactless substitute for traditional fitting rooms.
3. - **Fashion Design:** Designers can quickly try out clothing on a diverse range of virtual models.
4. - **Social Media Integration:** Users can share their virtual try-on experiences, boosting interaction.
5. **Accessibility:** Assists individuals with physical disabilities in trying on clothes on their own.

5. CONCLUSION:

The suggested real-time virtual try-on system for Android devices provides a comprehensive clothing visualization experience, exceeding the constraints of earlier models. It is efficient, user-friendly, and seamlessly integrates pose estimation techniques alongside cloud storage solutions. By accommodating both upper and lower-body apparel and ensuring compatibility with mobile platforms, the system brings virtual fashion closer to reality for everyday shoppers. This system highlights that precise, real-time garment fitting is possible on consumer-grade devices using open-source tools and cloud services.

Future directions include:

- Introducing real-time 3D garment simulation utilizing GLB or FBX models.
- Improving pose estimation accuracy with hybrid models.
- Incorporating AR-based background rendering for more immersive settings.
- Implementing GANs to create realistic lighting and texture blending.

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