VIRTUAL TRY-ON TECHNOLOGY

A MINI-PROJECT REPORT

Submitted by

ADHITHYA A 221701004

SURYA N 221701059

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RAJALAKSHMI NAGAR

THANDALAM

CHENNAI - 602 105

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RAJALAKSHMI ENGINEERING COLLEGE

CHENNAI – 602105

BONAFIDE CERTIFICATE

Certified that this project report **"VIRTUAL TRY-ON TECHNOLOGY"** is the bonafide work of **ADHITHYA A (221701004)**, **SURYA N (221701059)** who carried out the project work for the subject CD19651 – Mini Project under my supervision.

SIGNATURE	**SIGNATURE**
Prof. Uma Maheshwar Rao	**Mr. S. Pradeep kumar**
Head of the Department	**Supervisor**
Professor and Head	Assistant Professor
Computer Science and Design	Computer Science and Design
Rajalakshmi Engineering College	Rajalakshmi Engineering College
Chennai - 602105	Chennai - 602105

Submitted to Project and Viva Voce Examination for the subject

CD19651 – Mini Project held on_____.

Internal Examiner External Examiner

ABSTRACT

The Virtual Trial Room is a web-based application designed to enhance the online shopping experience by enabling users to try on clothing virtually. Built using Flask, OpenCV, and Python, the system provides a realistic and interactive way to visualize how garments would look on a user before making a purchase.The application processes images from a webcam or uploaded photos, utilizing OpenCV for image processing and body feature detection. Flask manages the backend, handling user interactions and processing requests, while Python powers the overall functionality of the system. By overlaying digital clothing onto a user's image, the Virtual Trial Room helps customers make informed purchasing decisions, reducing uncertainty and return rates.Future improvements include enhanced UI/UX designs, AI-based fit detection for better accuracy, and an expanded product catalog. This project aims to revolutionize online shopping by providing a more interactive and personalized virtual trial experience.

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ADHITHYA A (211701004)

SURYA N (211701059)

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CHAPTER 1

INTRODUCTION

The Virtual Trial Room is a web-based application developed using Flask, OpenCV, and Python to provide users with a virtual clothing trial experience. One of the major limitations of online shopping is the inability to try on clothes before purchasing, often leading to size mismatches and high return rates. This project aims to overcome that challenge by allowing users to overlay selected clothing onto their images in real-time.Flask serves as the backend framework, handling web requests and managing application workflows. OpenCV is used for image processing, including face and body detection to align clothing accurately with the user's image. Python powers the entire system, ensuring smooth execution of image processing tasks and web functionalities. The system processes webcam input or uploaded images, applies transformations, and adjusts garments to fit the user's posture and position.Planned enhancements include improving UI/UX design, integrating AI-based fit detection for better accuracy, and expanding the product catalog. By providing an interactive and realistic clothing trial experience, the Virtual Trial Room aims to revolutionize online shopping.

CHAPTER 2

LITERATURE REVIEW

2.1.Traditional Virtual Trial Room Approaches

The Virtual Trial Room is a web-based application developed using Flask, OpenCV, and Python to provide users with a virtual clothing trial experience. One of the major limitations of online shopping is the inability to try on clothes before purchasing, often leading to size mismatches and high return rates. Flask serves as the backend framework, handling web requests and managing application workflows. OpenCV is used for image processing, including face and body detection to align clothing accurately with the user's image. Python powers the entire system, ensuring smooth execution of image processing tasks and web functionalities. The system processes webcam input or uploaded images, applies transformations, and adjusts garments to fit the user's posture and position."UI/UX design of educational on-line courses" (2022-03-21), considers the problem of an interface for educational platform, which is fully effective for achieving the outcomes of educational activity.

2.2. Computer Vision-Based Virtual Try-On Systems

With advancements in OpenCV and deep learning, computer vision-based systems have improved significantly. Methods such as pose estimation, face detection, and segmentation have enabled more accurate garment alignment on a user's body. Some studies utilize Deep Learning models (e.g., Convolutional Neural Networks - CNNs) for body segmentation and clothing warping, making the trial experience more realistic.

2.3. Web-Based Virtual Trial Room Solutions

Recent developments in Flask and Python have enabled the creation of web-based virtual trial rooms that do not rely on AR but instead process images using image processing techniques. These systems detect key facial and body landmarks using OpenCV, apply transformations to adjust clothing alignment, and allow users to try on clothes through a browser interface. Compared to AR-based methods, web-based solutions are more accessible and lightweight, as they do not require high-end hardware.

2.4. Relevance to This Project

The Virtual Trial Room project leverages Flask, OpenCV, and Python to develop a lightweight, web-based solution. Unlike AR-based systems, it focuses on image-based processing to align clothing on the user's body. By incorporating advanced UI/UX designs and AI-based fit detection, this project aims to overcome common limitations and provide a practical, accessible virtual try-on experience for online shoppers

CHAPTER 3

SOFTWARE USED

The Virtual Trial Room project utilizes various web technologies, computer vision libraries, and backend frameworks to create an interactive virtual try-on system. The major software components used in this project are categorized as follows:

3.1. Backend Technologies

The backend is developed using Flask, a lightweight Python web framework that handles server-side processing, user requests, and data flow between the frontend and image processing modules. Python serves as the core language for writing backend logic, integrating OpenCV functions, and managing image-processing tasks efficiently.

3.2. Image Processing & Computer Vision

To process user images and overlay virtual clothing, the project utilizes OpenCV (Open Source Computer Vision Library). OpenCV is responsible for face and body detection, feature extraction, and image transformations like scaling and rotation. Additionally, NumPy is used for numerical operations, efficient array processing, and image data manipulation, ensuring fast and optimized computations.

3.3. Frontend Technologies

The frontend of the application is built using HTML, CSS, and JavaScript, providing users with an interactive interface to upload images, select clothing, and adjust overlays. Flask integrates with Jinja2, a templating engine, to dynamically generate web pages. If needed, Bootstrap can be used for enhancing the UI, ensuring responsiveness and a better user experience.

CHAPTER 4

PRSENT TECHNOLOGY

4.1. Computer Vision-Based Virtual Try-On

Computer vision plays a crucial role in detecting body features and overlaying garments onto user images. Open-source libraries like OpenCV are widely used for face detection, body segmentation, and key-point extraction, allowing virtual clothing to be positioned accurately. Machine learning models such as DeepLabV3 and PoseNet enhance accuracy by identifying precise body landmarks, improving the realism of virtual try-ons.

4.2. Augmented Reality (AR) and 3D Virtual Try-On

Many modern virtual trial rooms incorporate AR and 3D technology to create real-time try-on experiences. AR-based applications, using tools like Vuforia, ARKit, and ARCore, track the user's body movements and adjust clothing in real-time. Additionally, 3D scanning and body measurement technologies allow users to visualize garments with proper fit and draping, reducing the gap between online shopping and in-store trials.

4.3. AI-Based Fit Prediction and Clothing Simulation

Artificial intelligence has improved virtual try-ons by offering personalized recommendations and accurate size predictions. AI-powered models analyze body shape, movement, and past preferences to suggest the right size and fit. Deep learning techniques, such as Generative Adversarial Networks (GANs), help generate realistic clothing overlays, making virtual garments appear more natural.

4.4. Web-Based Virtual Trial Rooms

With the rise of e-commerce, many brands have introduced web-based virtual trial rooms that run directly in browsers without requiring additional app installations. Technologies like Flask, Django, and JavaScript-based frameworks (React.js, Three.js) enable seamless integration of virtual try-on features into online shopping platforms. This approach makes virtual trial rooms accessible, lightweight, and cost-effective for both businesses and consumers.

4.5. Limitations and Challenges in Current Technology

Despite advancements, virtual trial rooms still face challenges in clothing alignment, real-time adjustments, and user engagement. Most 2D-based virtual try-ons lack depth perception, making it difficult to replicate the way clothing drapes on different body types. Additionally, background noise, lighting variations, and computational limitations affect the accuracy of virtual try-ons. To address these challenges, future technologies aim to integrate AI-driven real-time tracking, 3D body scanning, and enhanced pose estimation for a more immersive and realistic experience.

4.2.1.LIMITATIONS

Despite the advancements in computer vision, augmented reality (AR), and artificial intelligence (AI), virtual trial room technology still faces several challenges. These limitations affect the accuracy, user experience, and practicality of virtual try-on systems. The key limitations include:

1. Accuracy Issues in Clothing Alignment

One of the primary challenges in virtual trial rooms is ensuring precise clothing alignment and fit. Most systems rely on 2D image overlays, which may not perfectly align with the user's body structure, leading to unrealistic or distorted clothing placement. Without 3D body scanning or depth detection, it is difficult to simulate how fabrics drape and move naturally.

2. Lack of Real-Time Movement Tracking

Current virtual try-on systems, especially image-based solutions, struggle to track real-time body movements. Unlike AR-based systems, which use motion tracking, simple OpenCV-based virtual try-ons rely on static images, making them less interactive. This limitation affects the overall user experience, as users cannot see clothing dynamically adjust with their body motion.

3. Lighting and Background Interference

The accuracy of computer vision-based body detection is affected by lighting conditions and background clutter. Poor lighting can lead to incorrect landmark detection, while complex backgrounds may cause misalignment of virtual clothing. While background removal techniques can help, they are not always precise, especially in low-light environments.

4. Limited Personalization and Fit Prediction

Many virtual trial room applications do not accurately predict size and fit. Unlike AI-driven systems that analyze body shapes, simple virtual try-ons often use one-size-fits-all clothing overlays, which may not represent the user's actual fit. Without AI-based size recommendation models, users may still struggle to find the right fit, leading to inaccurate shopping decisions.

5. High Computational Requirements for 3D Try-Ons

Advanced 3D virtual trial rooms require high processing power for real-time rendering, pose estimation, and fabric simulation. This can be challenging for users with low-end devices or slow internet connections. Web-based solutions that rely on Flask and OpenCV are lightweight but lack the realism of high-end 3D AR solutions, which demand powerful GPUs and complex machine learning models.

CHAPTER 5

PROPSED DESIGN

The Virtual Trial Room is designed as a web-based application that enables users to try on clothing virtually using Flask, OpenCV, and Python. The system follows a structured approach to ensure smooth image processing and user interaction. The architecture consists of three main components: the frontend, backend, and image processing module. The frontend, developed using HTML, CSS, and JavaScript, provides an intuitive interface where users can upload an image or capture one using a webcam. It also includes features for adjusting the position, scaling, and rotation of the virtual clothing overlay.

The backend, powered by Flask, is responsible for handling user requests, managing application workflows, and processing image-related tasks. Python scripts integrated with Flask ensure seamless communication between the user interface and the image processing module. The image processing module, which utilizes OpenCV and NumPy, is responsible for detecting facial and body landmarks, extracting key points, and overlaying selected clothing onto the user's image. This module processes images in real time, ensuring that the virtual clothing aligns accurately with the detected body features.

The workflow of the application begins when a user uploads an image or takes a snapshot using a webcam. OpenCV then detects facial and body landmarks to identify key points for accurate clothing placement. Once the clothing is selected, the system applies image transformations such as scaling, rotation, and translation to fit the garment onto the user's body. The final image is displayed on the web interface, allowing users to manually adjust the clothing position if needed. Additionally, users can download the processed image or try on another outfit.

To enhance the experience, the system offers key features such as real-time image processing, interactive UI controls, and web-based accessibility without requiring additional software installations. Future improvements include background removal techniques for better clothing placement, AI-based fit detection to automate garment alignment, and an expanded product catalog to provide more clothing options. In the long run, the system could also integrate 3D pose estimation models to create a more immersive virtual trial experience.

The proposed design ensures that the Virtual Trial Room remains lightweight, efficient, and user-friendly, making it a practical solution for enhancing online shopping. With planned advancements in UI/UX design and AI-based enhancements, this project has the potential to revolutionize the virtual clothing trial experience.

5.1 USER FLOW DIAGRAM:

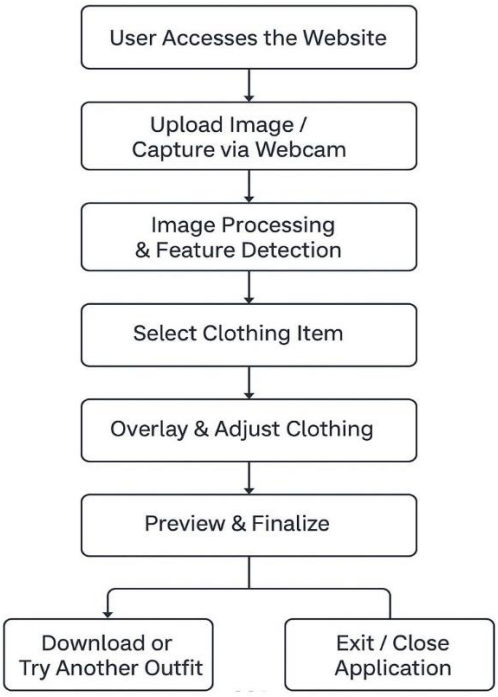

Fig.1 User Case Diagram

5.2 ADVANTAGES:

Advantages of the Virtual Try-On Technology Project :

The Virtual Trial Room project, developed using Flask, OpenCV, and Python, offers several advantages that enhance the online shopping experience and improve user engagement.

5.2.1.Enhances Online Shopping Experience – Users can virtually try on clothing before making a purchase, increasing confidence in their choices and reducing uncertainty.

5.2.2.Reduces Product Return Rates – By allowing customers to see how an outfit looks on them beforehand, this system helps minimize returns due to size or style mismatches.

5.2.3.Web-Based & Easy to Use – The project is designed as a web application, making it accessible from any device without requiring additional software installation.

5.2.4.Cost-Effective Solution – Unlike AR-based virtual try-ons that require high-end hardware, this system uses computer vision and image processing, making it a lightweight and budget-friendly alternative.

5.2.5.Quick & Real-Time Processing – OpenCV enables fast image processing, ensuring that clothing overlays are applied in real-time with minimal delay.

5.2.6.Customization & Scalability – The system can be expanded to support different clothing styles, backgrounds, and user preferences, making it adaptable for various fashion brands and e-commerce platforms.

5.2.7.Supports Manual Adjustments – Users can reposition and resize the clothing overlay to ensure a better fit, improving accuracy compared to rigid virtual try-on solutions.

CHAPTER 6

OUTPUT

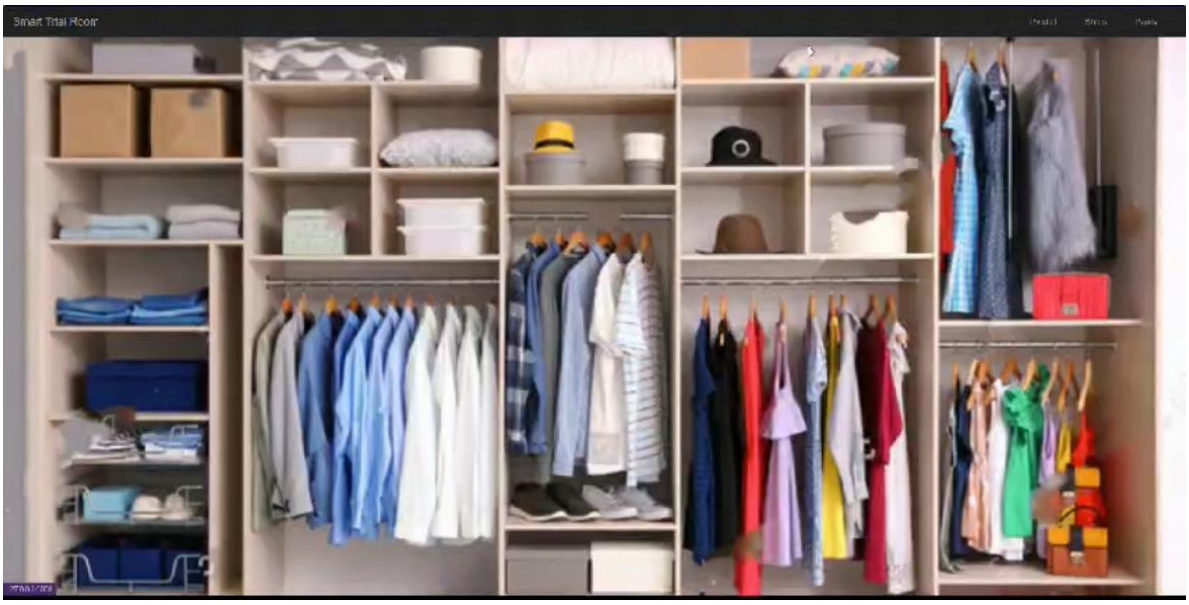

Fig 2: Home Page of Virtual Try-On Technology

This page have the options to select the cloths that you going to try-on virtually.

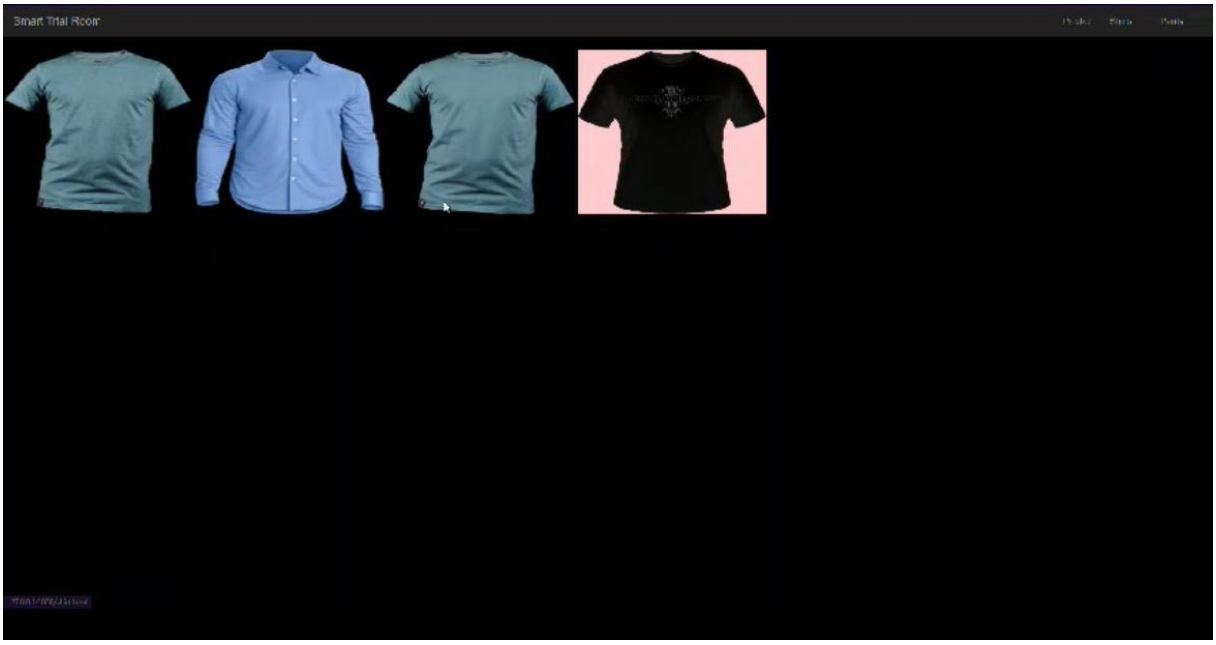

Fig 3: User can select the Top wear

Users can able to select the top wear like shirts , t-shirts and etc.,

Fig 4: User can select the Bottom wear

Users can able to select the bottom wear like pants , jeans and etc.,

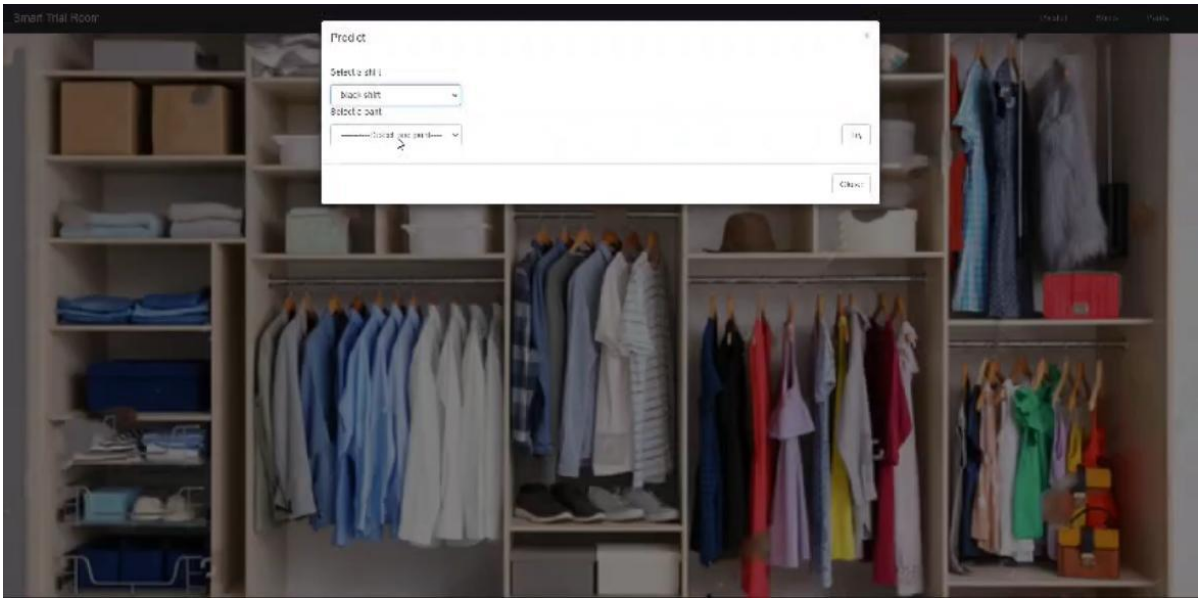

Fig 5: User can choose the color of the dress

After selecting the color of the dress they need to click on try button then the user need to move some distance from the camera .

CHAPTER 7

CONCLUSION

The Virtual Trial Room project provides an innovative and accessible solution to one of the biggest challenges in online shopping—the inability to try on clothes before purchasing. By leveraging Flask, OpenCV, and Python, the system enables users to overlay virtual clothing onto their images, offering a realistic and interactive fitting experience. Unlike AR-based systems that require specialized hardware, this web-based approach ensures greater accessibility and ease of use.

Through computer vision techniques, the project successfully detects body features and aligns clothing onto the user's image. However, challenges such as accurate garment fitting, varying lighting conditions, and different body postures still exist. Future enhancements will focus on AI-based fit detection, UI/UX improvements, and an expanded product catalog to further enhance the user experience.

Overall, the Virtual Trial Room is a promising step toward reducing return rates, increasing customer confidence, and enhancing the online shopping experience. With continued advancements in image processing and AI, this technology has the potential to revolutionize the fashion e-commerce industry.

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