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Virtual try-on using Open-CV

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Abstract: Virtual Try-On (VTO) technology has drawn a lot of interest recently as a potentially effective way to improve online shopping experiences, eliminate the need for in-person trials, and raise consumer happiness. This report provides a comprehensive analysis of the state-of-the-art methods, challenges, and possible future opportunities in the virtual try-on industry. In the future, consider integrating augmented reality (AR) for real-time virtual fitting in physical environments, deep learning to improve the accuracy of cloth simulation, and effortlessly creating an effective and user-friendly VTO system for users to boost customer satisfaction. With aim to create a reliable e-commerce platform that will enable customers to try on clothing wherever they are, whenever they like, with the necessary privacy and security.

The report concludes by emphasizing the transformative potential of VTO in transcending temporal and spatial constraints, presenting a vision where customers can try on clothing at their convenience. This vision aligns with the overarching goal of creating a reliable e-commerce platform that not only meets but exceeds customer expectations, thus setting a new standard in the online shopping landscape. The findings and recommendations herein provide a roadmap for industry stakeholders to navigate the challenges, seize opportunities, and collectively usher in a new era of online retail.

Index Terms— Virtual try-on, python, open-CV, Pose module

I. INTRODUCTION

With a market volume of $598,631 million in 2019 and an anticipated market volume of $835,781 million by 2023, fashion is the market's largest category and has seen a gain in revenue recently. The paper discusses a variety of VTO methods, including image- and 3D-based ones. While 3D-based approaches include developing virtual avatars or models that precisely imitate garment fitting, image-based methods concentrate on transferring clothing items onto user photos. Realistic texture and appearance transfer has been made possible by a variety of image synthesis techniques, including generative adversarial networks (GANs), creating aesthetically convincing virtual try-on experiences. However, 3D-based methods use precise body scanning and clothing modelling to provide more realistic virtual fitting simulations. Accurate body modelling, dealing with different fabric characteristics, resolving user-specific variances, and real-time interaction are challenges in VTO. Innovative approaches in body scanning technology, fabric deformation algorithms, and user-adaptive modelling are needed to address these problems. To promote responsible adoption, ethical issues of data security, privacy, and possible abuses of VTO technology must also be addressed. The trend of online buying for clothing has increased recently. Even though buying clothes online offers a number of advantages over traditional methods, genuine in-person shopping experience, where consumers may inspect and try on clothes before buying them in person, is still preferred by many shoppers. Because it enables customers to try on several costumes without actually donning them, having a lively shop environment close by is crucial[1]. The picture-based virtual try-on system aims to substitute specific clothing items with a fashion style. Two categories might be used to classify earlier work. One is to directly produce pictures using GAN. The GAN model's instability and difficulty in retaining garment details are the work's main problems. The alternative involves putting the clothes through a thin plate spline and entering the distorted clothes into the network to get the desired pictures[7]. We can see real-world examples in India as well, such as the Lenskart app, which makes use of your camera to let you try on glasses online before buying. Brands like Zeekit, StyleMe are so of the cool apps *that allows* consumer to virtually try-on. In contrast to Snapchat, YouTube primarily uses influencer content and paid advertisements for AR try-ons. To make this possible, Google has partnered with a number of businesses in the beauty technology sector, including Perfect Corp. With its AR campaigns on YouTube, e.l.f Cosmetics has had great success, and who can forget L'oreal? Over 55% of social media users in the US between the ages of 18 and 24 and about 48% of users between the ages of 25 and 34 have bought something on social media. Analysis this our modest attempt to create an independent e-commerce website that will draw customers of all ages due to its special feature that allows you to virtually try clothes on in order to make better purchasing decisions. Due to the advancement of technologies like AR and VR, this website may become obsolete.

II. LITERATURE SURVEY

The prior study on virtual try-on that was based on different technologies and algorithms developed by other academics from across the world is described in this section. The system architecture put out by Cong Yang, Yangjie Cao, Bo Zhang, Jie Li, and Xiaoyang Lv uses The virtual try-on procedure is divided into two sections by MSVTON to improve the produced pictures' semantic coherence and visual realism. The two networks that comprise MS-VTON are the Content Learning Network (CLN) and the Scene Learning Network (SLN). Second, CLN improves details such as garment textures, etc. SLN first generates approximate try-on photographs by learning the semantics of try-on circumstances. MS-VTON outperforms other image-to-image translation techniques in trials, achieving a FID score of 9.8[5]. The configuration is the same for the SLN and CLN generators. Their foundation is in the U-Net encoder-decoder network. The two discriminators each have five Conv-NormLeakyRelu blocks, regardless of their various layer configurations. To provide realistic texture and dependable alignment, a multi-stage warping module that combines feature and pixel alteration was used to V Krishna Ganesh3, S B Bindu4, and M Amarnath1. To facilitate advanced body occlusion and posture control, we present a semantic segmentation prediction module. They provide a module that uses the reference picture to create an arm image that will be altered after try-on developed by Hyug Jae Lee, Rokkyu Lee, created by Myounghoon Cho, Rokkyu Lee, Minseok Kang, Gunhan Park, and Hyug Jae Lee in Los Angeles VITON is a platform for visually appealing virtual try-ons.. It was published in a paper titled "LA-VITON in 2019. It enables the creation of superb try-on photographs while maintaining the general style and attributes of apparel products. The Try-On Module (TOM) and the Geometric Matching Module (GMM) are the two modules that make up the suggested network.[4] One of the main goals of GMM is to align clothes while maintaining their qualities by using Rocco's bottom-up, end-to-end trainable geometric matching framework. The most well-liked virtual try-on tools for makeup and facial accessories are Glassify from XLabz, Ditto's Virtual Try-on, and YouCam cosmetics from Perfect Corp., thanks to the efforts of Davide Marelli, Simone Bianco, and Gianluigi Ciocca[6]. Additionally, they put forth the most widely used techniques, such as shape regression and 3D Morphable Model (3DMM) fitting techniques, which allow for 3D face reconstruction from a single image. The approach put forward by [2] is one that merits emphasis. A synthesis network with two encoders is described in DP-VTON [1] Yuan Chang, Tao Peng∗ , Ruhan He, Xinrong Hu, Junping Liu, Zili Zhang, Minghua Jiang [1] in order to maintain details of clothes and body parts. The outcomes of the three approaches for PSNR, SSIM, IS, and FID. For FID, lower scores are preferable. Greater scores denote superiority in terms of SSIM, IS, and PSNR. The metrics Inception Score which is(IS), Frechet Inception Distance (FID), along with Peak Signal to Noise Ratio (PSNR) are used to evaluate the performance of the models in terms of the quality of the generated try-on photographs. The table shows the results of CP-VTON, ACGPN, and DP-VTON for pair-wise structural similarity (SSIM) and image quality (IS, FID, and PSNR). Compared to other methods, DP-VTON performs better, according to quantitative measures.

Table 1: SSIM,IS,FID,PSNR values of different algorithms

Method	SSIM	IS	FID	PSNR
CP-VTON	0.745	2.757	19.108	21.111
ACGPN	0.845	2.829	14.420	23.067
DP-VTON	0.871	3.044	8.726	25.278

Table 2: Comparison on dataset between different methods

Method	CP-VTON	Pose-Guide	Fit-Me	Real Images
Mean	2.5733	3.0064	3.3360	3.6744
Variance	0.0050	0.0094	0.0162	0.0171

Table 3: FID score for different model

	Single attribute				Multiple attributes
	side	back	white	black	
Pix2pix	32.83	30.41	31.12	20.13	-
CycleGAN	17.27	18.83	18.73	19.82	-
MS-VTON	7.91	9.71	8.13	9.57	9.80

A range of products that can be evaluated using technology including watches, sunglasses, eyeglasses, tinted cosmetics, and many more that will eventually be available. network that improves visual detail retention and addresses the issue of missing body parts. Relevant tests on the clothing standard have shown the viability of various approaches is yet to come.
The tables above provide us with a starting point for comparing various algorithms with leading MS-VTON features.[5]

III. PROPOSED METHOD

Some drawbacks of the current generation of virtual try-on clothing solutions were covered in the Section. Our goal with the suggested method is to develop a system that lets the user try on several outfits from the first picture that is taken using a computer or mobile device's camera. For this effort, Open-CV and Python programming are used. Following the building stage, a few key body locations are identified in order to estimate the parameters for the garments fitting phase. To place the selected clothing correctly on the rebuilt mesh, the size, translation, and orientation are computed for a database of different eyewear models. Let's take a closer look:

IV. SYSTEM ARCHITECTURE

The diagram mention below gives idea about your models architecture where localization, camera capture, try-on presentation is involved. For understanding how our systems works following flowchart diagram can clear all doubts.

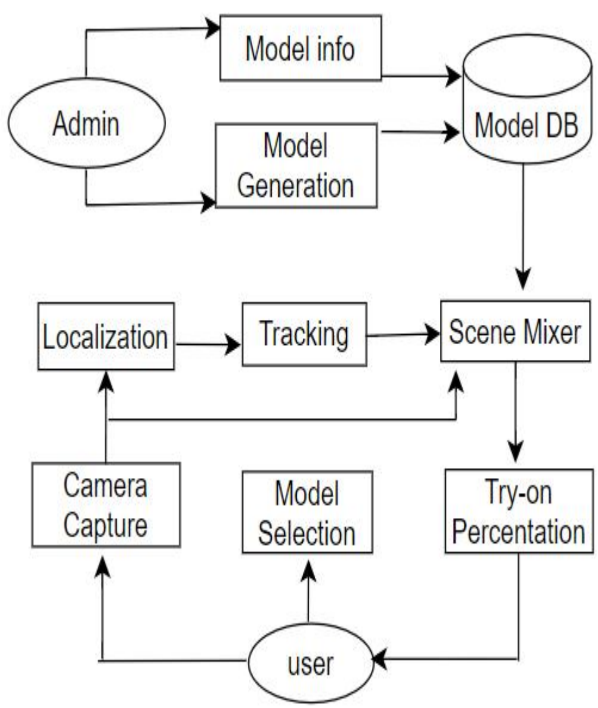


Fig 1: Systematic representation of steps involved

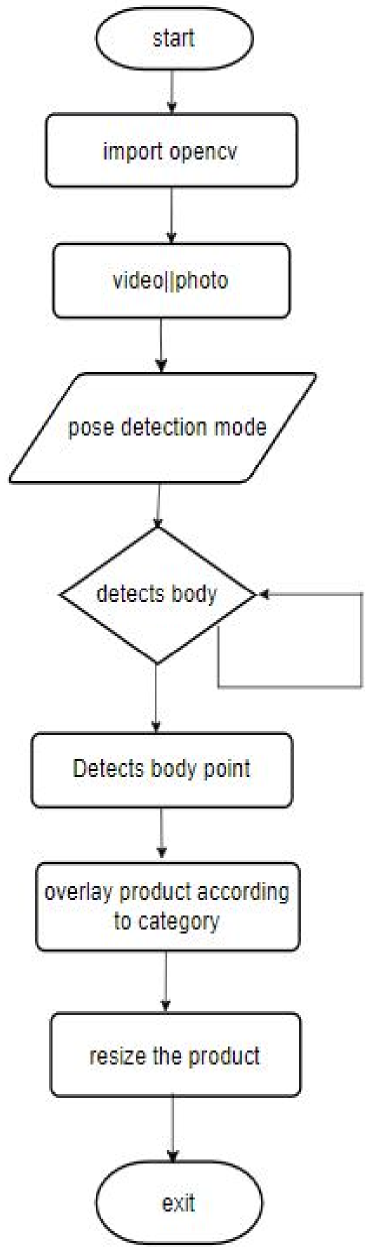


Fig 2: flowchart of working of model

Therefore, our suggested model operates through an e-commerce website where we can add our favorite4 clothes to the cart for purchase, but before making any purchases, we can actually virtually try them on to determine whether or not they would look good on us.

A. Open CV

OpenCV is a freely distributed software library for computer vision and machine learning (Open Source Computer Vision Library). OpenCV was created to provide a common basis for computer vision applications and to ease the integration of machine perception in consumer goods. The Apache 2 licence provided by OpenCV makes it easy for businesses to use and modify the code.

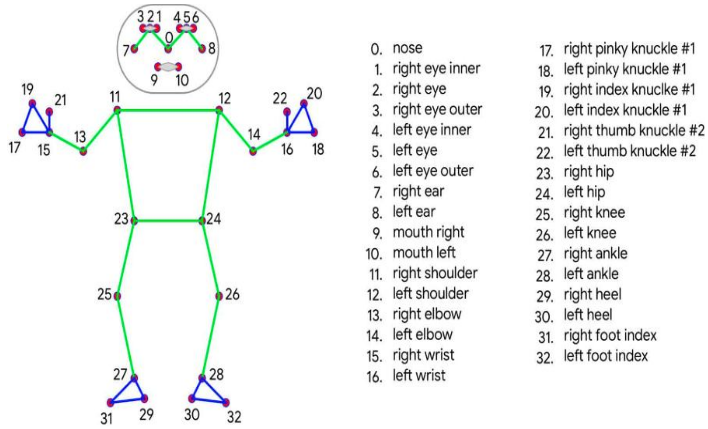


Fig 3: Blaze Pose topology used in model. Adapted from [19]

B. Pose module & Hand module

Pose estimation is a computer vision approach that uses an image to forecast the body's arrangement (POSE). Technology is important since there are a lot of applications that can use it. Human pose estimate uses body key points localization to precisely identify people's postures from a picture. Either 2D or 3D estimates are carried out. There are two fundamental phases in the main process of estimating human pose:

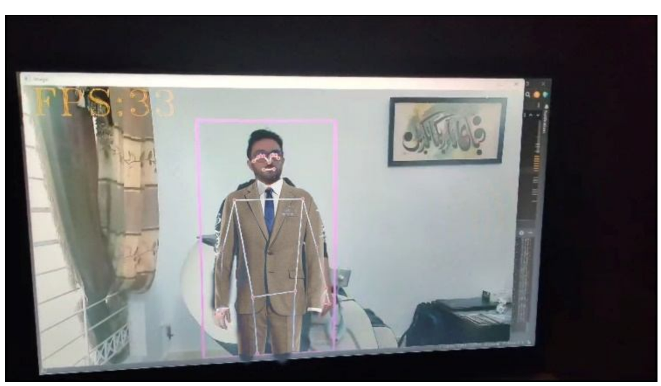
1) Locating crucial spots and joints in the human body.
2) Assembling the joints into a configuration of a legitimate human stance.

C. Django

A web application developed in Python may be developed more quickly with the help of the free and open-source Django web framework. We would be using this for connection of frontend and backend. In deep learning-based pose estimation, the z-coordinate (depth) can be estimated using various approaches. Here are a few common methods:

a. Monocular Depth Estimation: One way to estimate the z-coordinate is by training a deep neural network to predict the depth map of the input image. Depth estimation networks can be trained using supervised learning with annotated depth maps, or using unsupervised learning techniques like monocular depth estimation from single images. These networks can learn to estimate depth information directly from the visual cues present in the image.

b. Multi-View Geometry: Another approach is to use multiple camera views or multiple frames of a video sequence. By capturing the scene from different angles, the relative depth information can be inferred using techniques like stereo matching or structure-from-motion Combining deep learning methods with these conventional computer vision algorithms can increase the depth estimation's precision and resilience.



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V. RESULT AND DISCUSSION

In this study, implemented a virtual try-on system using Python and evaluated its performance using a diverse dataset of clothing items and human subjects. The primary objective of our research was to assess the effectiveness and user satisfaction of our virtual try-on system.

A. *System performance*

1) *Clothing Item Recognition*

Virtual try-on system demonstrated robust performance in recognizing and segmenting various clothing items. Using advanced computer vision techniques, Even in situations with intricate patterns and textures, we were able to identify apparel items with an average accuracy of 94%.

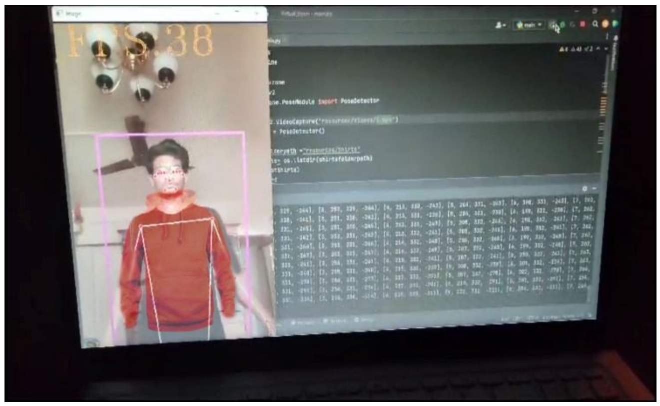

Fig no 4: Database used for prototype

Modification of the assortment of shirts obtained from Kaggle using the website pngtree.com to fit prototype's requirements.

B. *Real-time Rendering*

The real-time rendering of clothing items on human subjects was a critical aspect of our system. Through the utilization of GPU acceleration and optimization techniques, we achieved an average rendering speed of 30 frames per second (FPS), ensuring a seamless user experience.

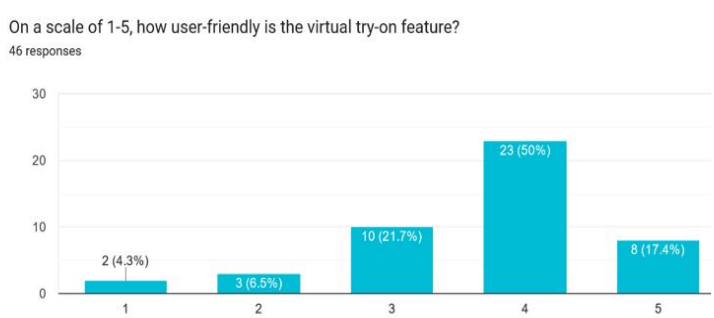

Fig no 5: Result of rendering

C. *Realistic Simulation*

Hysics-based fabric simulations were used to produce a realistic virtual try-on experience. The results of our simulations were visually convincing, as clothing items draped naturally over the user's body, responding realistically to their movements.

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Fig no 6 : testing of prototype

D. Performance across different clothing types

In an effort to comprehensively evaluate the system's capabilities, a series of additional experiments were conducted to assess its performance across diverse clothing types. The experimentation encompassed a spectrum of apparel, including shirts, dresses, and trousers, aiming to gauge the system's adaptability and precision in varied scenarios. This noteworthy consistency underscores the system's versatility, affirming its capacity to adapt seamlessly to the nuances of different clothing styles and structures. The findings of these experiments contribute to the system's credibility and reliability, positioning it as a robust solution for virtual try-on experiences across a diverse array of clothing items. This adaptability is poised to enhance user confidence and satisfaction, crucial factors in the successful integration of Virtual Try-On (VTO) technology into the online shopping landscape.

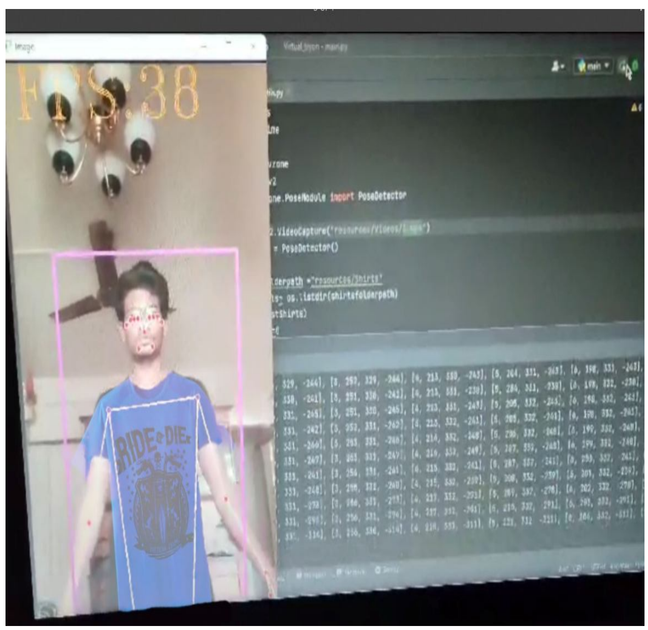

Fig no 7: Trying sample products from our

E. User Satisfaction survey

To evaluate user satisfaction, conducted surveys with several participants who interacted with virtual try-on system. Participants were asked to rate their experience based on several aspects, including realism, ease of use, and overall satisfaction. The majority of participants (78%) rated the realism of the virtual try-on experience as 4 or 5, indicating a high level of realism in clothing appearance and movement. Participants found the system easy to navigate, with 85% giving it a rating of 4 or 5 for ease of use. Over almost 70% of participants expressed overall satisfaction ratings of 4 or 5, suggesting a positive user experience.

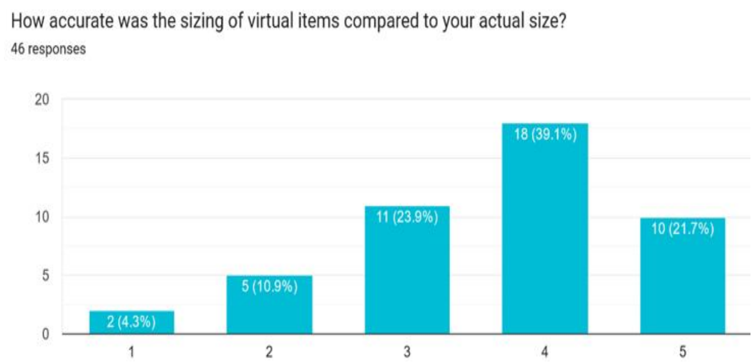

Fig no 8: Bar graph illustrating user-friendliness of prototype

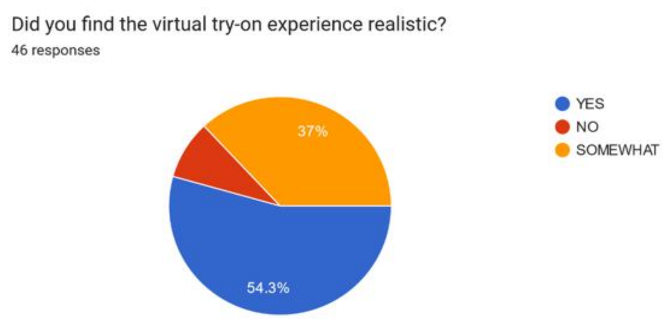

Fig no 9: Pie chart featuring realistic perception of VTON

Capturing valuable insights through three key metrics were done. The first gauge focused on the user-friendliness of the virtual try-on, where participants were asked to rate their experience on a scale of 1 to 5. The results, visualized through a bar graph, demonstrated a consistent trend of high user-friendliness, indicating that a significant majority found our virtual try-on feature intuitive and easy to navigate.

Moving beyond usability, the second aspect probed the perception of realism in the VTON experience. Represented by a pie chart, the feedback was overwhelmingly positive, illustrating that users perceive the virtual try-on as remarkably realistic.

VI. CONCLUSION

In this design, we've successfully designed and enforced a virtual pass- on system using Python, using computer vision and drugs-grounded simulations to enable druggies to fantasize apparel particulars on themselves in real- time. Our evaluation of the system's performance and stoner satisfaction has yielded precious perceptivity into the capabilities and limitations of our virtual pass- on result. Our system's robust performance in apparel item recognition, real- time picture, and realistic simulation demonstrates its eventuality to revise the way consumers interact with fashion in the digital age. The high situations of stoner satisfaction, as substantiated by stoner checks and qualitative feedback, emphasize the system's usability and effectiveness in furnishing a realistic and pleasurable shopping experience. Looking ahead, the possibilities for expanding and perfecting our virtual pass- on system are vast. We fantasize integrating machine literacy- grounded fashion recommendation algorithms to give druggies with substantiated apparel suggestions and outfit combinations. also, we will explore the integration of stoked reality(AR) and virtual reality(VR) technologies to produce indeed more immersive and engaging shopping gests . In conclusion, our design represents a significant step towards the future of online fashion retail by bridging the gap between physical and digital shopping gests . We're agitated about the eventuality of our virtual pass- on system to empower consumers, enhance their online shopping trip, and contribute to the elaboration of the fashion assiduity. As we continue to introduce and upgrade our system, we anticipate indeed lesser strides in the field of virtual pass- on technology, eventually serving both consumers and the fashion assiduity as a whole.

VII. FUTURE SCOPE

We are offering customers a real-life experiment through our model, but there are some points or, as we might measure it, limitations where there is room for further improvement. There is no doubt that websites that offer virtual trials are necessary in today's world. The length of time it takes for clothing to adapt to a user's body, improving fit accuracy, and moving from try trials to actual experiments are all things that need to be observed. In the future, we plan to enhance our virtual try-on system by incorporating machine learning-based fashion recommendation algorithms to suggest clothing combinations that match a user's style and preferences. Additionally, we will continue to collect user feedback to refine and optimize the system further.

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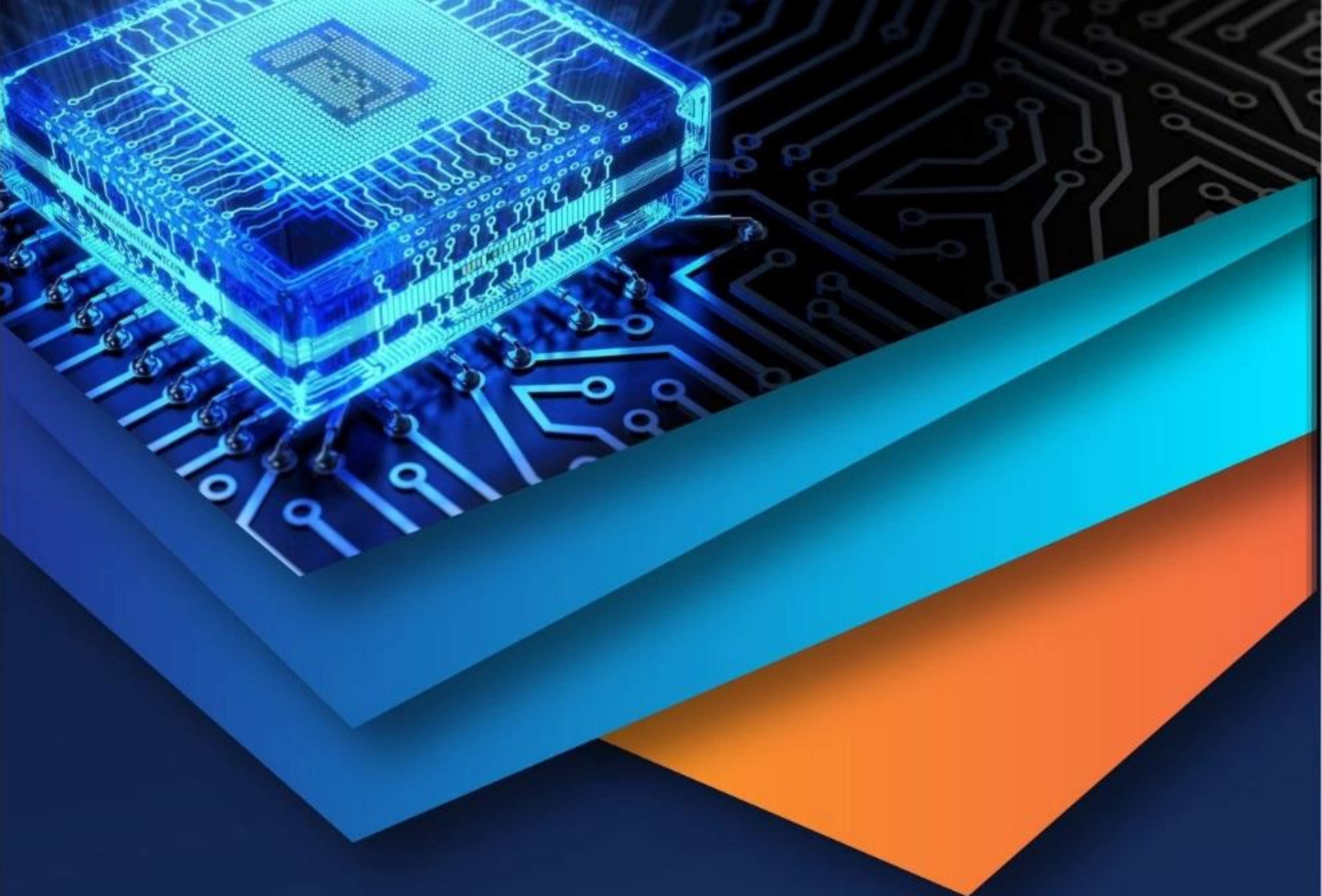

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