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Virtual Dressing Using Kinect Sensor

Dr. Santosh P.Jadhav, Ms. Nikita Borse,
Ms. Akshada Gahile, Ms. Vibhuti Gudaghe,
Ms. Swati Zagade

Maratha Vidya Prsarak Samaj's, Karmaveer Baburao Ganpatrao Thakare College Of Engineering, Udoji Maratha Boarding Campus, Gangapur Road, Nashik, Maharashtra, India.

ABSTRACT :

A large number of online shopping websites have popped up as a result of recent advances in web technology. Online shopping, however, has some disadvantages in addition to its benefits. Due to the wide range in body type, hair color, and size, it might be challenging for someone to imagine how a certain item will look on them and their skin tone, among other things, among humans. For both the client and the trader, evaluating thefit of clothing is crucial. Our methodology focuses on how the chosen outfit fits the user's body and how it would appear if he or she were in the actual world. It normally takes a lot of time to try on things in a store. Additionally, in situations like internet purchasing, it might not even be able to try on clothing. By establishing a virtual changing room setting, we hope to improve accessibility and time efficiency for trying on clothing. The installed system offered a cutting-edge technique that is presented for the purchase of apparel through a virtual try-on platform. This process takes a great deal less time than the standard procedure, making it simpler for both the vendor and the buyer. This offers a plausible behavior for the appropriateness of the garment's details. Theentire process begins with a webcam image of the user, which immediately creates the ambiance of a virtual dressing room.

Index Terms – Virtual dressing room, Virtual Try-On, Visualization, Virtual fitting, trial, augmented reality

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1. INTRODUCTION

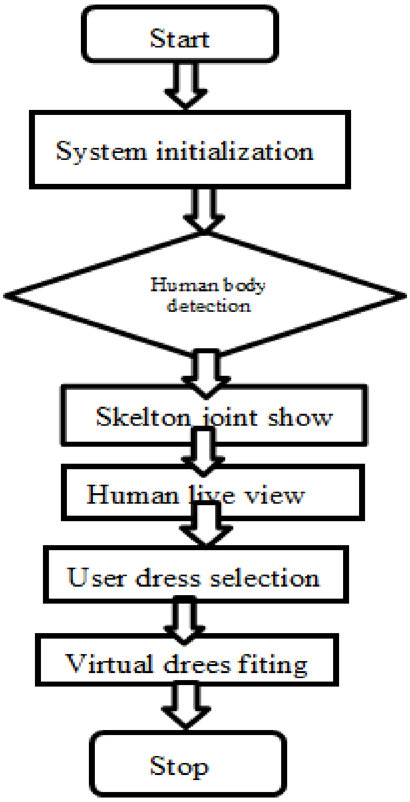
Smart technologies that streamline our activities have a significant impact on our daily lives as a result of the technology development industry's rapid growth. For example, online purchasing developed quickly. People are becoming more accustomed to using Internet stores, online auctions, etc., to buy the things they are interested in. This kind of transaction has taken over as the most popular one and offers customers a tonne of convenience. However, a drawback of online clothing shopping is that customers cannot test out the item before purchasing it. The client's decision to purchase the items is influenced by how they feel after dressing. As a result, there is a growing need for virtual dressing rooms that can imitate the visual aspect of dressing. In everyday life, people frequently try on clothing before making a purchase. Customers can physically try on garments and contact real people in physical stores,but they must put them on and take them off themselves, wasting time and energy.

Some people find it challenging or even impossible to try on certain types of clothing. The application's goal is to make trying on garments easier when shopping, which will be comfortable for both the merchant and the buyer.

Making a program that aids in this area was motivated by the desire tocut down on time and aid people in making a wide range of clothing selections, so it has become crucial (essential) to improve the comfort, simplicity, and effectiveness of the process of trying on and purchasing clothing. In addition, the rapid advancement of softwareprograms and current technology, as well as their spectacular emergence, have encouraged the broad development of this application. Direct communication between humans and computers is one of the primary drivers of this enormous advancement in technology. Since it relates to several aspects of human-computer interaction, including interaction for educational, amusement, medical, and e-commerce purposes. E-commerce is one of the contemporary concepts that have permeated our daily lives and is used in a variety of contexts that are connected to the information and communication technology revolution.

Numerous websites for online shopping have appeared as a result of recent advances in web technology. Online purchasing does have some disadvantages, despite these benefits. One disadvantage is that due to the wide range in body type, shape, and hair color, it may be challenging for someone to imagine how a particular item will appear on them.

in the human populace, including skin tone, etc. It is crucial for both the client and the trader to test the fitness of the clothing. Our method focuses on how the chosen clothing would look on the user and how it would fit the user's body in the actual world. Trying on clothing in a shop typically takes a lot of time. Additionally, in some situations, like the following, it may not even be feasible to try on clothes. By building a virtual changing room environment, we hope to improve accessibility and time efficiency for trying on clothing. The implemented system introduced a cutting-edge methodology that is presented for the purchase of clothing through a virtual try-on platform. This process takes a great deal less time than the standard procedure, making it simpler for both the vendor and the customer. This offers a plausible response for the appropriateness of the garment's details. The entire process begins with a webcam picture of the user, which immediately creates the environment of a virtual dressing room. Customers can choose clothing designs from a variety of outfits they like, and those can be tested on the image to give them a real-time view of the outfit as if it were being worn on their bodies. The main goal of this project was to create a desktop program that would enableusers to access an environment of a virtual try-on system while creating a compelling, interactive, and extremely realistic shopping experience.



Flow Chart

2. LITERATURE SURVEY

Virtual fitting. Creating photographs of a specific person wearing a desired outfit is a difficult task that necessitates accurately capturing the garment and appropriately styling it on the specific human body. The most basic try-on techniques attempt to swap out a single garment for a new one.[1] Applications for virtual changing rooms have drawn a lot of research. A technique and system to make it easier to recognize the body based on gestures that signify commands to commence actions were presented in [2] to initiate actions within an electronic marketplace on behalf of the user. Such that a model of the userbody is produced using the initial set of spatial data. The action machine then creates a second model using the second spatial dataset it has received. The action machine, which is represented by a gesture and which, in turn, symbolizes a command from the user, distinguishes the first model from the second model. Work is more closely connected to approaches that aim to simultaneously model each piece of clothing a person is wearing, enabling users to perform numerous garment try-ons [3]. The way Swap Net functions are by projecting every article of clothing from one target person's image onto the stance of another. This isaccomplishedby first creating a segmentation mask of the required attire in the intendedstance. proposed a Kinect sensor-based application for a virtual changing room. The suggested method relied on skin color detection, model alignment, and user extraction from a video feed. The 3D locations of thejoints were used for positioning, scaling, and rotation to align the 2D cloth models with the user.[4] Introduced garment modeling, which is based on building virtual bodies using accepted measurements. Splines are used to produce 2D clothing patterns, which then appeared around a computerized human body to give them their basic shape.[5] To create the appeared clothing, physical factors were applied based on actual fabric properties. A web browser that was integrated into a real-time platform was utilized as the internet's interfacefollowing the construction of the garment. A mobile application was shown in [6]. Customers can use the program to preview clothing before making an online purchase.On their mobile device, the client downloads the application. The user will then be asked other questions regarding the body after that. A brand-new idea for augmented reality in changing rooms was presented in [6]. Customers may easily imitate trying on while also getting a feel for the textiles thanks to this technology. Instead of a mirror, the dressing room features a camera and a projection surface. Customers affix visible tags on their clothing. The chosen article of clothing is then mixed into and fitted to the customer's body in an AR video start that is captured by the ARDressCode application function and provided on an AR mirror. Real-time clothing simulation and tag-based motion tracking in an enhanced changing room [2005]: For changing rooms, a novel idea for augmented reality was presented.[7] Customers may easily imitate trying on while also getting a feel for the textiles thanks to this technology. The ARDressCode app's feature records anAR video feed and displays it on an AR mirror with the chosen item of clothing mixed in and tailored to the user's physique.

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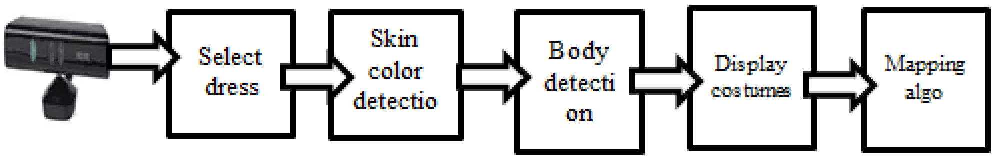

Figure 1

The suggested method collects dynamic video using a webcam, then uses the Haar cascades classifier to identify various body components, such as the head, face, eyes, and lower body. body, then an algorithm for detecting skin. The operational distance between the camera and the subject is thenadjusted based on the predicted distance. The dress model is then scaled to fit the situation.

Figure 1 illustrates the superimposition of a dress model in real-time using the subjects' footage. The next subsections outline the suggested method.

A. FACE AND LOWER BODY DETECTION

Face and lower body detection are performed using the Haarcascades classifier. The face is crucial. entity for detecting the presence of a subject inside the operative frame. To make it simple to identify the pieces, Haar uses various types of contrast. The collection of pixels is depicted in Figure 2 by the rectangles. These pixels will make it easier to easily find the body portion. Haar is used for face and body detection. The detectionof the lower body is carried out using Haar classifiers. The haar classifiers perform functions including detecting the eye, face, and body in moving videos to identify humans. The Virtual Dressing Using Kinect Sensor 5 haar classifiers are used to infuse the negative and positive samples of photos, and the results are recorded as.xml files. For OpenCV to detect a human, the cascades of haar cascade upper body, haar cascade lower body, haar cascade full-body, haar cascade frontal face, etc. are used. The haar employs Region of Interest (ROI). For audibly evaluating pixels in squares, it is based on the "Haar Wavelet Method." This is referred to as "training data," and it makes use of machine learning strategies to obtain greater levels. Its properties have been estimated using the "integralimage" idea. To provide the classifier with effective results, Haar cascades employs the Ad boost learning algorithm, which chooses a few crucial features from a big set. With the haar classifier, one can identify the lower body.

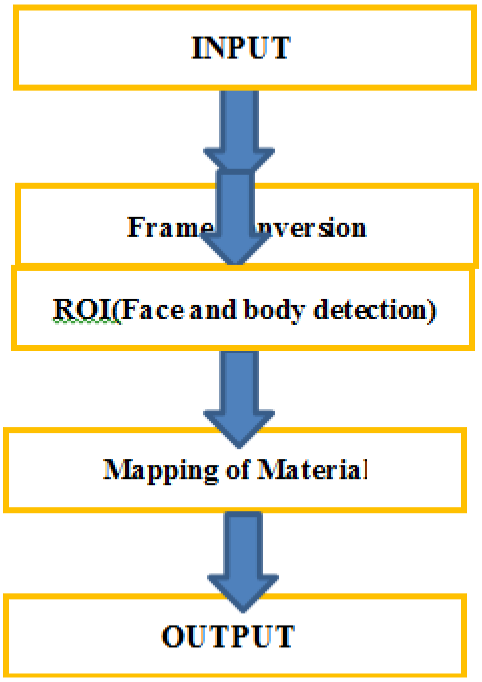

Figure 2 Flow chart of Face Detection

B. SKIN COLOR DETECTION ALGORITHM

The identified skin pixels are then added to the detected faces and lower body regions. To keep the product unique, a skin color detection algorithm must be used in this situation. This program would perfectly and with no change fit the undiscovered body parts into the chosen outfit. To distinguish chrominance from intensity channels for the skin detection method, we convert the RGB image to YCbCr color space. Y denotes luminance information, and Cb and Cr denote information about chrominance. Cb and Cr stand for blue and red colors that deviate from the reference value, respectively. Y has an 8-bit range of 16 to 25, while

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the ranges of the blue and red components, Cb and Cr, are 16 to 240. Equation A contains the conversion formula from RGB to YCbCr.

$$\begin{bmatrix} Y \\ Cb \\ Cr \end{bmatrix} = \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix} + \begin{bmatrix} 65 & 128 & 24 \\ -37 & -74 & 112 \\ 112 & -93 & -18 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

The conforming skin pixel is in the range which is stated

below: $\boldsymbol{y} > 80\ (\boldsymbol{i})$ $\mathbf{85} < Cb < 135\ (\boldsymbol{ii})$

$\mathbf{135} < Cr < 180\ (\boldsymbol{iii})$

Where Y, Cb, Cr = [0, 255]

To account for the fact that everyone's skin tone is different—including Asians, Europeans, and others—a threshold range has been established. The skin color pixels in the video frame are divided using a histogram approach. Using the best threshold, histogram analysis will enable skin pixel differentiation. To determine the classifier or filter stage, use the threshold value. The Skin Pixel Quantifier counts the human skin-containing pixels to determine their percentage and separate them. The area of interest is the bounding box on a topic that is displayed in real-time. The bounding box is displayed on the body and the Haar classifier is used to detect the ROI image. Through the use of a mapping algorithm, dresses are mapped onto the subject, and following accurate detection, they are applied to the body. According to the subject's body measurement, this mapping will produce the desired outcome.

List the body detection readings as determined by Haar classifiers in Table 1.

Haar-cascade Classifier	Label	Stage	Size
Haarcasacade_frontface_ default	HD	25	24*24
Haarcasacade_frontface_ 1	HT	22	22*22
Haarcasacade_frontface_ 2	HT2	21	22*22

Haarcasacade_frontface_ aternative_tree	HTR	48	25*25
Haarcasacade_profile	HPF	30	25*25

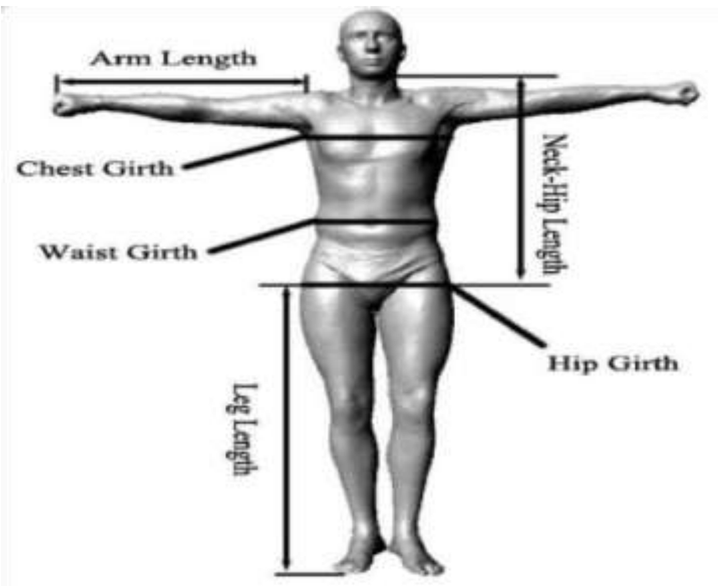
Table 1 Different sizes of Haar-cascade classifiers

C. DISTANCE CLASSIFIER TECHNIQUE

To calculate the dynamic distance between the camera and the subject, the Euclidean distance is used. When the person and camera are quite far apart, it will automatically To properly position the dress on the body, and rescale. Hemant and other individuals (2017) The Euclidian distance formula is shown in the example below:

$\Delta s\ ((x, y), (a, b)) = \sqrt{}(x - a)\ 2 + (y - b)\ 2$

Where a and b are the centroid coordinates of the subject, and x and y are the centroid coordinates of the camera. The distance is represented by s. The Euclidian distance, which can be measured in 3- or 4-dimensions, is used to calculate the length of a distance between two places. The most accurate and trustworthy method to calculate the distance between two places is thought to be this one. To calculate the distance, we used the Euclidean distance calculation, which is based on the Pythagorean formula. We have defined four points, namely x, y, a, and b. (x a) 2 + (y b) 2 is a formula for calculating the Euclidean distance.



Calculations of distances between Different body parts

D. MAPPING ALGORITHM

An advanced technology known as a mapping algorithm uses feature points to analyze the real world. Applications based on augmented reality that use the proposed method's mapping algorithm may recognize and identify 3D items. Together with it, it detects the object immediately and enables the overlay digital interactive augmentation. The device uses the subject's 3D position to target it, compute the distance between objects, and classify it at various key points.

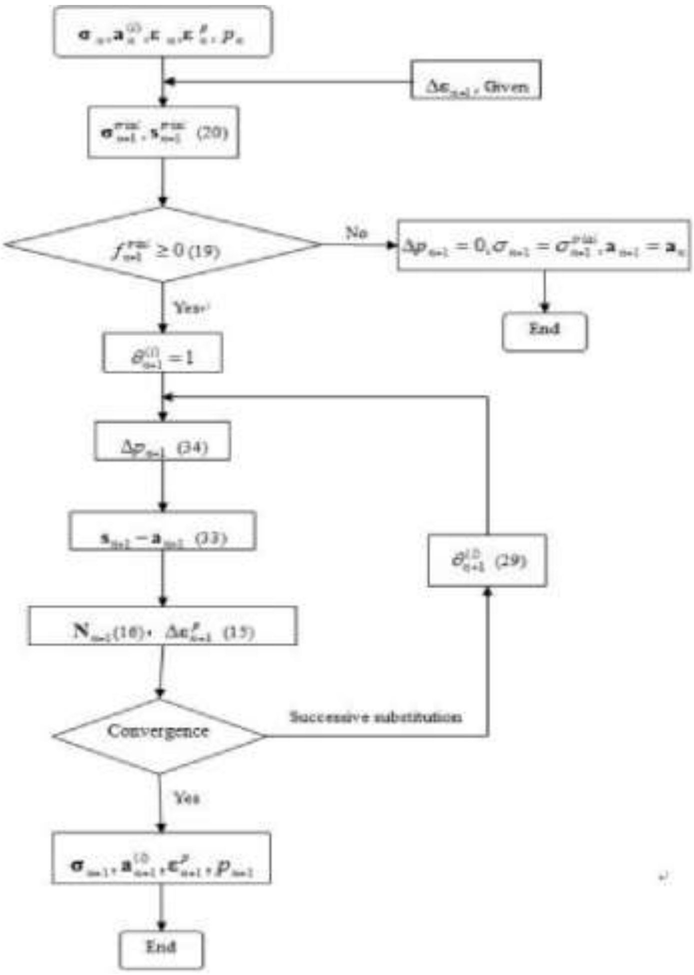


Figure4 Flowchart of mapping algorithm for Rate Independent

3. PERFORMANCE ANALYSIS

To decrease time and increase accessibility for trying on apparel, we are creating a virtual changing room environment. The technology modifies

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the color and texture of the shirt when the person wearing it is free to walk around and apply elastic deformations to the material, such as stretching and bending, in front of a mirror.

In any case, turn to face the camera. Our objective is to build an extremely lifelike, interactive virtual machine that lets consumers try on clothing without really donning it. The customer can use this virtual dressing room to see how he looks wearing the preferred dress model. The next decision s whether or not to buy clothing. To leather is one of the primary goals of a virtual dressing room.

Extraction from the Input Image or Human Detection By segmenting the user area, the user can virtually create an environment and overlay it on the user interface. Also, for skin detection, identifying the area of interest is helpful. Both the user ID and the depth image are taken. The depth image is what defines how the user's clothing will fit when the device is in use. identifying human remains Identifying whether and where human bodies may be observed in an image is the main goal of this stage. The expected outputs of the step are the patches in the input image that contain each body part. To create a more organic look, the body alignment procedure is subjected to extensive study and basic styling.

4. COMPARISON

4.1 Comparison of features with AR model

The current systems made use of Kinect sensors. The virtual fitting room is made feasible by AR application, one of the available methods that use a standard camera. This technique was based on static augmented reality,where the individual had to make adjustments as the costume was automatically displayed on the screen. according to that.

Additionally, because the body cannot be found, it does not produce accurate results.

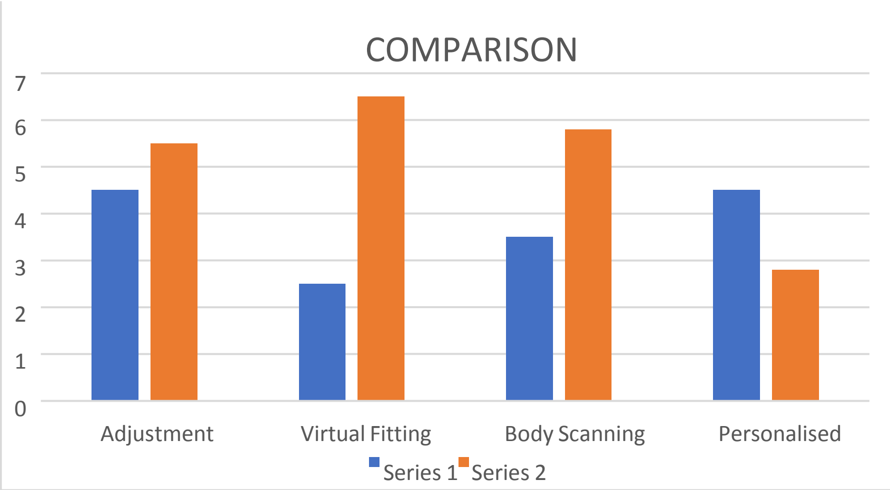

Figure 5: Comparison of features with the AR model

The body's dimensions were not recorded, and the garments were not correctly mapped to the body. Figure 8 shows graphs that contrast existing augmented reality (AR) models with our model. These comparisons were made after carefully examining the outcomes of numerous existing AR models, which improved the comparability of our model's virtual fitting and body scanning features. This is due to the mapping algorithm's precise mapping of the body and its innovative use of the go-ahead skin detection method for all skin tones. As a result, the findings of a comparison

are more obvious.

Features	AR Models	Proposed Model
Adjustment	4.0	5.5
Virtual fitting	2.0	6.2
Body Scanning	3.5	5.8
Personalization	4.0	5.0

Table2:Comparison with AR application fitting using static augmented reality

4.2Comparison of our model with the existing application present on the internet.

The virtual dressing rooms is can be implemented in two different ways. One way is using 2D input and the other is using 3D input. There are some 2D systems are available in the market. There are some systems that produce results of 3D capture of the human model and cloth using the physical parameters of the products.2D systems are done with the help of predefined human model pictures. 3D model can be implemented using a Kinect sensor. The 3D model gives a more accurate result than the 2D model as it uses the RGB color motion detection using the depth sensor By using our 3D model of virtual dressing the user can feel the clothes virtually depending on the movement of the user.

4.3 Comparison with Magic Mirror System.

When compared to the magic mirror coordination, when a subject is placed in front of the mirror and a dress is then thought to be worn by the subject. Magic mirror largely eliminates features. The following graph illustrates the comparison between feature extraction and feature reduction:

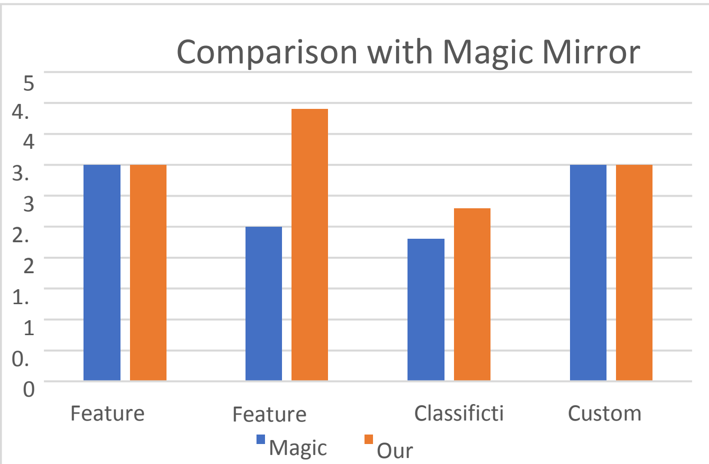

Figure 5: Comparison with Magic Mirror System.

Our model differs from others due to the whole-body extraction algorithm, which is unique in that it can identify every sort of skin tone. But other solutions allow consumers to digitally try on their outfits and often operate exclusively on skin detection. The body's overall contour is provided by the mapping algorithm, which also precisely places the dress on the identified body components.

5. CONCLUSIONS

The infrastructure we've developed for ongoing virtual maintenance is practical and efficient. The approach consists of two crucial steps: choosing the outfit and taking the picture. Customers and shops can benefit from continued virtually changing area frameworks in many ways, such as saving space and reducing waste. material attempted. Also, it doesn't need any physical area and is considerably simpler to operate. In this manner, the framework makes use of image manipulation and expanded reality to resize the information dress photographs in consideration of the body size excited for precisely combining clothing over the subject body. By using virtual dressing rooms rather than actual ones, this virtual dressing room may be able to address the sizing issue. Furthermore, it is made simpler for folks to select the ideal clothing.

6. ACKNOWLEDGMENTS

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