

Online Virtual Trial Room Implementation using OpenCV Python

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Abstract - People usually avoid buying wearables like clothes, ornament, etc. online mainly because it's hard to judge whether it will look good on them or not. To solve this problem, we decided to build an Online Trial Room Application. Our research is based on creating an application which takes a video of the user using the device camera and then divides the video into individual frames from which it extracts the user's body. Finally using functions to extract information on the placement of joints in the body and to transform, rotate, and scale the wearable image onto the user in real-time. In the literature review, we go through various ways to achieve our goal with their advantages and disadvantages. The project is implemented in Flask Web application with OpenCV a Python Module. The application works on devices with an inbuilt or attached camera, internet, and web browser.

Key Words: Wearables, Online Trial Room, OpenCV.

1. INTRODUCTION

Buying wearables online is always a risky process as there is always a doubt whether how the item will look on oneself. Also, buying clothes or ornaments through shops offline requires a lot of time as we have to first look for a shop and then try each and every cloth by going inside the trial room. Our proposed solution will help users save their time in trying out the wearables by digitizing the process. We decided to use OpenCV because it is much faster and pretrained to detect user body on which we will super impose the cloth hence saving their time while providing them with excellent user experience. The user will get results in real time i.e. the output with the wearable superimposed will be provided simultaneously while taking the input by catching every frames of the video and applying the attire on the user's body in that video frame and then returning the frame back which will give user the feeling that the results are displayed in real time. The implementation doesn't require any hardware cost making it highly cost-effective solution unlike some of the proposed works in the section II. The application proposed is also platform independent i.e. it can run on any operating system on any device as long as the device has a camera and access to the internet and a web browser. The two major concerns of this project are i) Accuracy of superimposing of wearables according to the user and ii) Realistic View.

1.1 Accuracy of Superimposition

This is the first concern of a virtual trial room and is very essential as it decides the accuracy of the whole system. The accuracy highly depends on whether or not the application's algorithm is able to find the user in the video frames or not. There are two major ways we can do this, first is using neural networks to train our algorithm to find the human body in the frame and the second is to use a marker like an RGB colour to pinpoint the user in the frame using this colour pixels. The later one is not very user friendly and luckily OpenCV already has a trained algorithm designed to recognize body parts like face, upper body and lower body and hence we will go with the former method.

1.2 Realistic View of the Virtual Trial Room

Virtual Reality implementation is no good if it does not feel reality though its only possible if the user can get the exact same feeling as they get when they wear a cloth like the feeling of wearing a cotton cloth is different from that of wearing woolen cloth. Though even though we can't provide with that level of realism right now at least we can make user's view more realistic as if they are trying the cloth in a mirror inside an actual Tryon room.

Augmented Reality is direct and indirect view of real-world elements that are augmented on computer software. Augmented Reality considers real and virtual elements. It mainly adds the software information and refines the users view to the actual environment. In most augmented reality pleas, a user will see both synthetic and natural light. This is done by overlaying projected images that allow the images and interactive virtual objects to a layer on top of the user's view of the real environment. Augmented Reality devices are often self-contained, they are completely untethered and do not need a cable or desktop computer to function.

OpenCV is an abbreviated form of Open Source Computer Vision Library which supports python, C++, java interfaces. It is basically designed to for achieving computational efficiency and also to give emphasis for real time applications. This package has an added advantage that is multi core processing when the code is written in C or C++. Using augmented reality technology reduces the time of the customers and also the chaos created while purchasing the wearable by virtually trying them online.

2. RELATED WORK

We have gone through various papers which had similar idea of super imposing an attire usually clothes on a human body. This helps the user to visualize his/her in a wearable without actually wearing it. Initially the user needs to face the camera which focuses the user image and fit various costumes to it and displays. This basically helps the user to know his/her choice easily and provide greater level of satisfaction.

According to the papers [1], [2] and [6] which are proposed by **Shreya Kamani**, **F. Isikdogan** and **Vipin Paul** respectively, the implementation of virtual trial room application is proposed with the usage of a hardware sensor known as Microsoft Kinect sensor which mainly takes the bone measurement of a person which is a way to determine the size of user's body on which the virtual cloth has to be augmented. There are several commercial products available now in the market for virtually trying out clothes. This has reached a boom in the market. So, the current existing technique which is in a popular demand is using Microsoft's Kinect and Asus Xtion devices. In this when the person stands in front of the screen which is which is with a Kinect scanner it detects the human body according to its coordinates and prepare a human skeleton as per that. As soon the structure is made a 3D model of the user is prepared.

In paper [3] which is proposed by **Cecilia Garcia Martin**, an android application is integrated with the concept of augmented reality. There the proposed technology is augmenting the virtual cloths on a users' static image and the whole application is dumped in an android phone. The application Virtual Trial Room can be visualized in varied perspectives and can be implemented using various hardware - software integrations. One such is the usage of OpenCV for this application development. This idea has been proposed in [4] and [5] by authors **Nikki Singh** and **Sourabh Botre** respectively. This idea gave cost effective and accurate results and hence was a major influence to our implementation.

3. IMPLEMENTATION METHODOLOGY

3.1 Detecting and Sizing the Body

First step of the proposed Online Virtual Trial Room method is the acquisition of the shape of the body, head or neck depending upon the wearable to get reference points. Reference points are then used to determine where to display the particular cloth or ornament. In order to obtain the body shape, we applied several techniques: i) Filtering with thresholding, Canny edge detection, K-means, and ii) Motion detection or skeleton detection wherein multiple frames were analysed for any movement. However, the results were unreliable and not good enough to obtain reference points for displaying the wearable. Therefore, we

introduced a new detection methodology based on locating the face of the user, adjusting a reference point at his/her neck and displaying the wearable based on that point. In addition, another point of reference can be obtained by using an Augmented Reality (AR) marker. Though this was enough for small attires like glasses or ornaments but it was not enough to map the clothes onto the user body.

deltax	deltay	8-code	corresp 4-code
0	1	0	0
-1	1	1	
-1	0	2	1
-1	-1	3	
0	-1	4	2
1	-1	5	
1	0	6	3
1	1	7	

Fig. 1. – Freeman's Codification

For obtaining the size of the user, we follow a similar automated body feature extraction technique as shown in [7]. The idea is to set up the user in front of the camera and hold him at the beginning at a certain predetermined distance. The algorithm extracts points on the shoulders and the belly. Measuring the distance between these points and knowing the distance from the user to the camera, the size of the user can be obtained. When the image (video frame) is acquired, a canny edge detection filter is applied to obtain only the silhouette of the body. Canny edge detection is really susceptible to noise that is present in unprocessed data; therefore, it uses a filter where the raw image is convolved with a Gaussian filter. After convolution, four filters are applied to detect horizontal, vertical and diagonal edges in the processed image. Morphological functions are also applied to obtain a closed silhouette. Finally, an 8-points Freeman chain code, shown in Figure 1 is applied to assign a direction to each pixel. We can choose to apply 8 or 4 chain code, then the following formula can be used:

$$z = 4 * (\text{deltax} + 2) + (\text{deltay} + 2) \quad (1.1)$$

which gives the sequence corresponding to rows 1-8 in the preceding table: $z = \{11, 7, 6, 5, 9, 13, 14, 15\}$. These values can be used as indices into the table, improving the speed of computing the chain code. Each variation between consecutive numbers represents a variation of 45° so if the difference of direction between consecutive points is measured and if the change is more than two (90°) then a feature point is detected and marked in the image.

$$ek = |dj + 1 - dj| = 2 \quad (1.2)$$

This is the same than saying that the absolute difference between two points is bigger than 2 as Eq. (1.2) States.

Finally, the distance between them is measured in the image and related to the distance from user to the camera to obtain the size.

3.2. Face Detection

As when the user comes in front of the screen, to detect the user the discrete structure which is to be identified is the face. So, to detect the face, we use Haar feature-based cascade classifiers. In haar classifier instead of using intensity values of the pixel, it uses the change in contrast values between adjacent groups of pixels. Then the variance difference between the pixel groups is used to determine the relative light and dark areas in the image [8]. It is a machine learning approach. So, to work well with the algorithm the cascade function is trained from a lot of negative and positive images. A lot of negative images (images without faces) and positive images (images with faces) are shown to the classifier to train it so it can extract features from it.

The purpose of using OpenCV makes it easier as it comes with pre-trained classifiers for face, eyes, smile etc. It comes with a trainer and a detector; we can train it with our own classifier easily for any object detection. If it finds a match it returns $Rect(x, y, w, h)$ implying coordinates for left, top, bottom and right.

3.3. Image Masking

In this simply the image masked has some of its pixel intensity values set to zero. In the image wherever the pixel intensity value is zero automatically the pixel intensity of the resulting masked image will be set to the background value which is normally zero. Or To define the mask the ROIs for each slice is used. If required, masking can be controlled on slice by slice basis in ROI toolkit. In ROI toolkit, masking operations does not affect a slice without ROI.

3.4. Edge Detection

There are various edge detection techniques. We have used Canny Edge detection technique [9] as discussed before for detection of body. To perform this edge detection technique Gaussian filters are used. These filters cut out the noise in a digital image to prevent any false detection by the processor. This does the work of smoothening and reducing the effect of noise on the image for the proper functioning of the processor. With this the intensity gradients of the image are not found out. The edges in the image can point in various directions like horizontal, vertical and in diagonal edges, so this algorithm uses four filter to detect all kind of edges in blurred image. After this process non-maximum suppression is applied to make the edge thin. This suppression results in quite accurate edge pixels in reference to present real edges. Also, some pixels may be caused by the noise, then for such pixels we apply double threshold on them.

3.5. Scaling of Attire

Scaling means resizing of the image according to the circumstances. As when the user moves in front of the screen it should change the sizing of the attire and place it on the body accordingly. When the user moves towards the screen the image size should be increased according to user but the actual measurements of the attire should not increase. Suppose the person is trying out clothes with a measurement size S, as when the person moves in front of the screen the size should not change to a size M or L. Just the overall view of the cloth should be increased or decreased accordingly. This is done by scaling method.

3.6. Proposed Application

The application is developed with Python Flask Web Application Interface. The user can view clothes and other wearables on the website and choose to buy or try on the attire. If the user wants to try on the wearables online then they must click on the 'Quick View' button. This will run the Tryon script. Through OpenCV the video is captured via the device camera and the attire image is super imposed on the user's body in real time. If the user likes the attire then they can choose to buy it or keep looking at more wearables on the website just like an offline store.

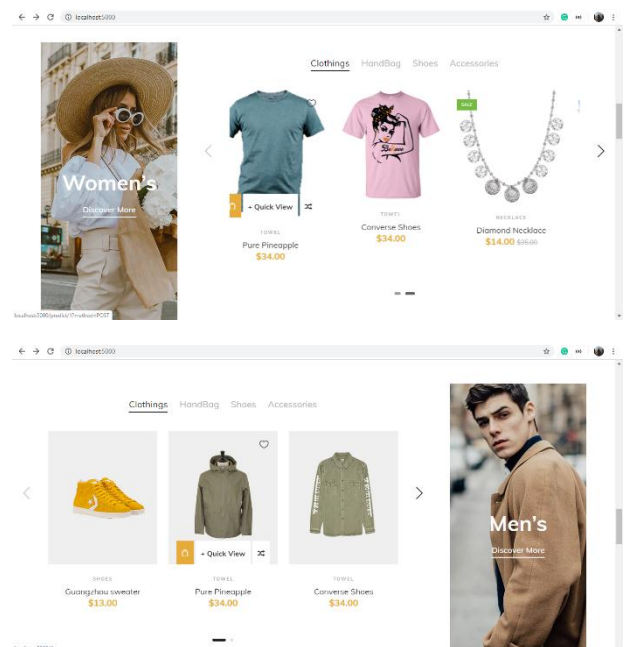


Fig. 2. Screenshots of the Web Application

4. RESULT

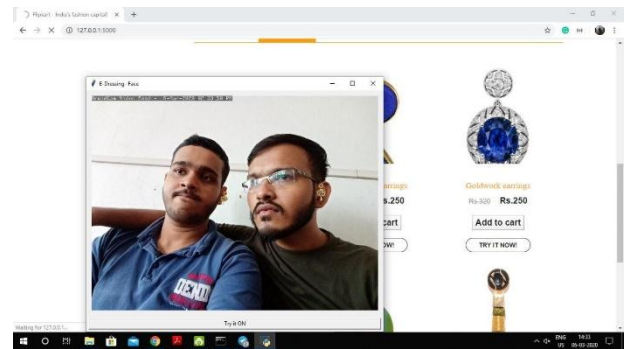
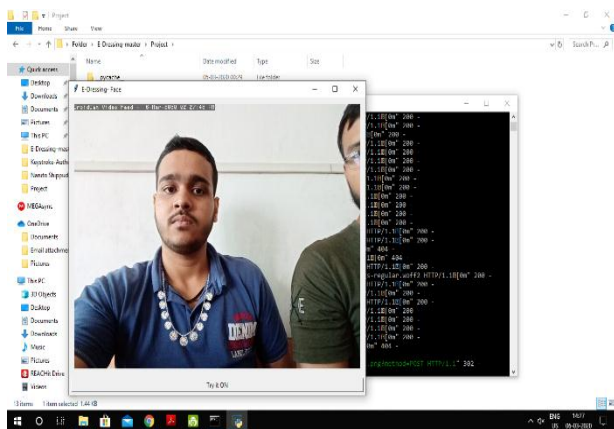


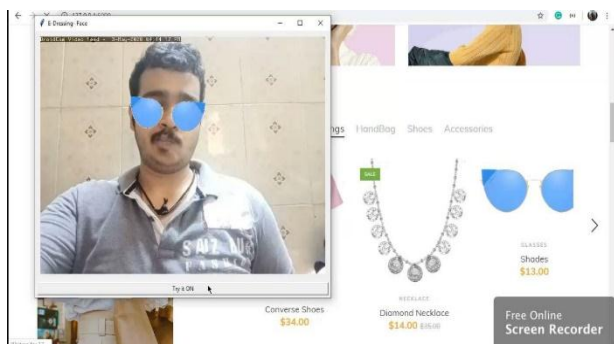
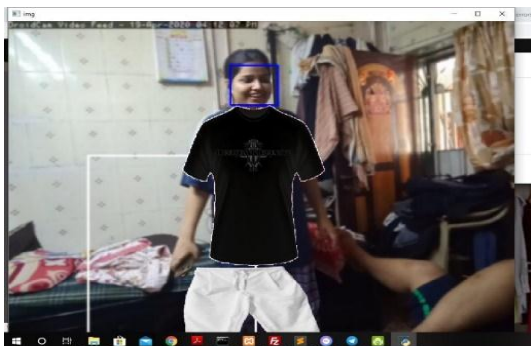
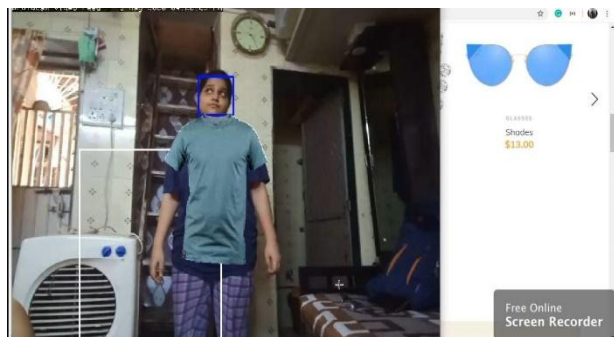
Fig. 3. Screenshots of the attires super imposed on the user

5. CONCLUSION

In conclusion, a Virtual Trial Room was implemented successfully in Python OpenCV. This application can help users save time of going to the shops to try on attires which they can do online as well. The application is able to track user's movement and angles with respect to screen to accurately super impose the attire onto the user without having the user to align to the device screen hence improving user experience. The application can be used by online retailers and vendors to sell their wearable products which will surely attract more customers. Last but not the least there is a scope for improvement in the accuracy of the application specially when it comes to clothing which can be achieved by taking multiple snaps of the cloth in different angles and then aligning the particular angle of the cloth with the particular angle in which the user is standing tilted. Also having the clothes in multiple sizes like S, M and L will further improve the accuracy of the application.

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