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Augmented Reality: Enhancing Online Shopping Experience for Virtual Eyewear Try-On

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ABSTRACT: The trend from buying products in market has been shifted to buying products online and websites like PayTm, Ebay, Snapdeals, Homeshop18.com, Flipkart, Amazon etc are a helping hand to do so. But still there is a huge gap of consumer trials in reality e.g. trying/ wearing eyeglasses by visiting the shop or purchasing the eyewear by only looking at the image has big experimental/real difference. In order to reduce this gap, some new technologies are approaching like Augmented Reality. The objective is to bring Virtual Reality into e-commerce for enhancing human experience for trying out eyeglasses and lenses online. For this, user experiences Virtual Reality in laptops & desktops instead of using costly devices like RGB-D Camera, XBOX etc. and hence introducing the same concept with cheaper devices & with nearly same experience. Here, we describe a model to recognize human facial movements left-right and other facial feature recognition in video stream and combine it with virtual eyewear in motion matching as near real-experience.

KEYWORDS: Energy efficient Virtual Reality; Image Processing; 3D Object Augmentation; Real time; Key Frames; Streaming; Computer Vision; Augmented Reality.

I. INTRODUCTION

Taking the user experience of online shopping and its associated problems into considerations we propose an application and techniques for enhancing the user experience with ease of adaptation. Our propose system do not require any special hardware device for capturing the human interaction or for providing the virtual experience to user.

Using Virtual Reality we can allow users to interact with the simulation in a manner which provides a real-time experience of trying the eyewear. Virtual Eyewear tryouts requires human facial information and the eyewear . But to provide a realistic view it is necessary to capture the 3D facial information along with its motion. This is easily achieved in our system by using the laptop camera. This ensures ease of access to the application without incurring extra cost on special device like depth cameras. Since most of the laptop users are already adapted to their device camera so they won't need any training to interact with our application, making it very easily adaptable and available to masses.

Virtual Reality is the computer generated simulation of a three dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using electronic equipment, like a helmet with a screen inside or gloves fitted with sensors.

To achieve this we have used 3D Augmentation to augment the positions of eyewear over the face at respective Point Of Interests. The output stream is created by combining the composed key-frames into a unit of single stream. Thus user can interact with video stream using the mouse and experience the trying of glasses virtually. To create a simulation rendering the glasses requires use of object augmentation. The perfection of the proposed application depends upon the analysis of the facial features and rendering of eyewear at proper position over the face. This is

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achieved by first extracting the human facial features and then creating the Point of Interest on face for key frames in video stream. POI's are also captured from the eyewear for its every possible position on the face.

II. Related work

Pedro Azevedo requires RGB-D camera to obtain the depth information of the face adding cost of this device to the user [1]. This limits the access to the application to those having the specified hardware only. Moreover to provide better experience the system requires rigorous training of human face which is taken from Kinet and other databases. The virtual experience of glasses over the face is first given to the morphable model and then the model is fit to the original shapes [1]. Such computations require heavy computational backend devices incurring more cost for the service providers.

However as stated in *Making 3d Glass Try on Practical,* the eyewear is directly fitted to the face by considering the difference between structure of original face and the general model [2]. But to capture the facial depths it uses RGB-D camera. This requires larger training of face in order to avoid corner errors.

But to increase the accessibility *Vision Based Virtual Eye-Glass Fitting* works directly by using the laptop camera [3]. But this fails in capturing the motion information and is limited to the frontal look of eyewear over the face. This stagnant the virtual experience. This has one added advantage that it works with real instance rather than uploading once picture and then showing the output.

In our proposed system we are gathering the best of all. So making the task more tough as the accuracy of the system directly depends upon the algorithms used and its efficiency. Moreover this has to be achieved within a very short- time to keep the experience real for real-time interactions.

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Paper Name	An Augmented Reality Virtual Glasses Try-On System	Making 3d Glass Try on Practical	Vision Based Virtual Eye-Glass Fitting	Eye-Glass Try on Based on Improved Poisson Equation
Hardware Requirement	RGB-D camera	RGB-D camera	Simple Webcam	Simple Webcam. Works on Captured Image
Technique	1. Face Tracking to detect specific landmark in facial image 2. 3D facial morphable model fitting to users head and face	1. Active Appearance Model 2. Makes use of generic 3D face model	1. Detects the face and then the corner of the eyes. Uses affine transform by drawing the isosceles triangle using the eye-corner information. 2. Only the frontal information of eyeglasses is merged with the eye-corner points in real-time image	1. Combines Active Shape Model Feature Extraction algorithm with Image Composition Algorithm 2. Fidelity model is used to preserve the eye-glass on the face
Glasses fitting the user	This is obtained by deforming the chosen 3D objects from its rest shape to a deformed shape matching the specific facial shape of the user.	The eyeglasses are merged onto the face with respect to face movement on fix location	Only the frontal information of eyeglasses is merged with the eye-corner points in real-time image	Works with only front face
Output	Rendering the deformed combined objects on to the original image.	Eye-glass on face with motion.	Less Realistic	Very Costly computation
Drawbacks	1. Limited to frontal Face. 2. Not possible to extend for left -right movement. 3. Requires large dataset of the 3D face. 4. The image of the eye-glasses is also 2D. 5. Deformation has effect on the eyeglasses as they appeared bent from nose.	1. Occlusion can only be removed because of depth information. 2. Morphable model is harder to display over the screen and is more complex. 3. Sharp Corner occlusion of glasses over the face.	1. Combines only the frontal eye-glass over the face. 2. Fails with varying shapes of the eyeglasses.	1. Requires to upload the photo of user. 2. Occlusion of the eyeglass over the face.

Table 1.Comparative Study for Virtual Eyewear Try-on System

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III. PROPOSED ALGORITHM

A. *DESCRIPTION OF THE PROPOSED ALGORITHM:*

As stated in above section, to capture the best of both techniques our system is heavily composed of algorithms but our architecture hides this information and makes it easy for the end user to access the service. Our architecture will allow the customer to try the glasses on themselves virtually and thereby connect users more closely to online shopping. Thus adding real-time experience while selecting the eyewear while shopping online.

The input to our proposed application will be the video recording of the user's face. This video will be started only when the web camera or laptop camera is enabled. If it is disabled then the task is not allowed to progress further and will be stopped.

To ensure the facial information along with the motion is captured properly, our system continuously validates the face and its motion in each frame. To accomplish this, user needs to move the face as per the instruction of virtual model which is portrayed over the screen. This model is made such that it binds the user face with its boundaries and by following its motion directions the required information is captured.

Since the depth information is already retained with such motional face patter it is very necessary that it is captured correctly. So if user fails to follow the motion then user is interrupted with alerts of failing to follow the instructions and user is further guided to follow it again.

For composing the eyewear over the 3D information of face within real-time, it is necessary to apply below sets of algorithms.

1. Key frame Extraction:

The virtual scenes are created at the backend as it involves some computationally heavy algorithms which may be difficult to perform at client side. Thus the captured video along with the eyewear id is send over the Internet to our service. So there are high chances of corruption of some frames because of noise or delay. Some video frames may be repeated because of spikes in the network while others may not have relevant information. In order to clear this difficulty only key-frames are extracted from the video. This relaxes the number of frames in the computation.

2. Histogram Equalization:

Since we are focusing on large masses the variability of device is far large. This results in varying information of brightness, contrast, color enhancement and other information to vary a lot in the input video. So it is very much necessary to normalize these information for our system. Also even after Key-frame extraction, there are strong chances that the extracted frames are still very noisy and so histogram equalization is very necessary at this stage.

3. Principal Component Analysis

Within the input frame our focus is only on the face and its features. But not all the features are required to build our system. Moreover lower the features with more information faster the computation and better is the accuracy. Using PCA we ensure that all features with more information are retained and rest of least importance are removed thereby reducing the computation to less elements.

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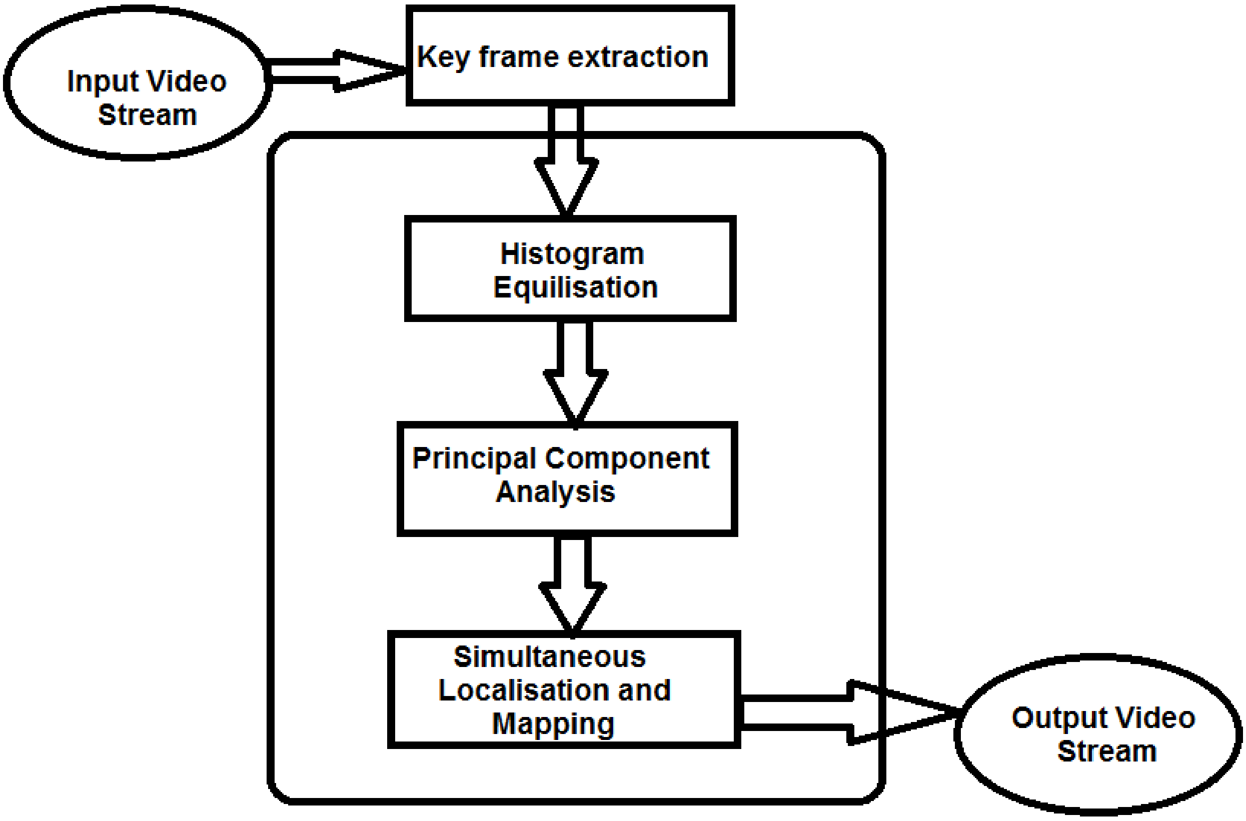

Fig.1. Steps involving the flow of different algorithms

4. Simultaneous Localization and Mapping (SLAM)

From the dataset, the eyewear (already 3D rotated) pin-points will be taken and SLAM process will be applied. SLAM is basically Simultaneous Localization And Mapping used to localize and map (superimpose) the eyewear over human face. After that, frames are converted back to video and thus resulting into the interactive motion control video output.

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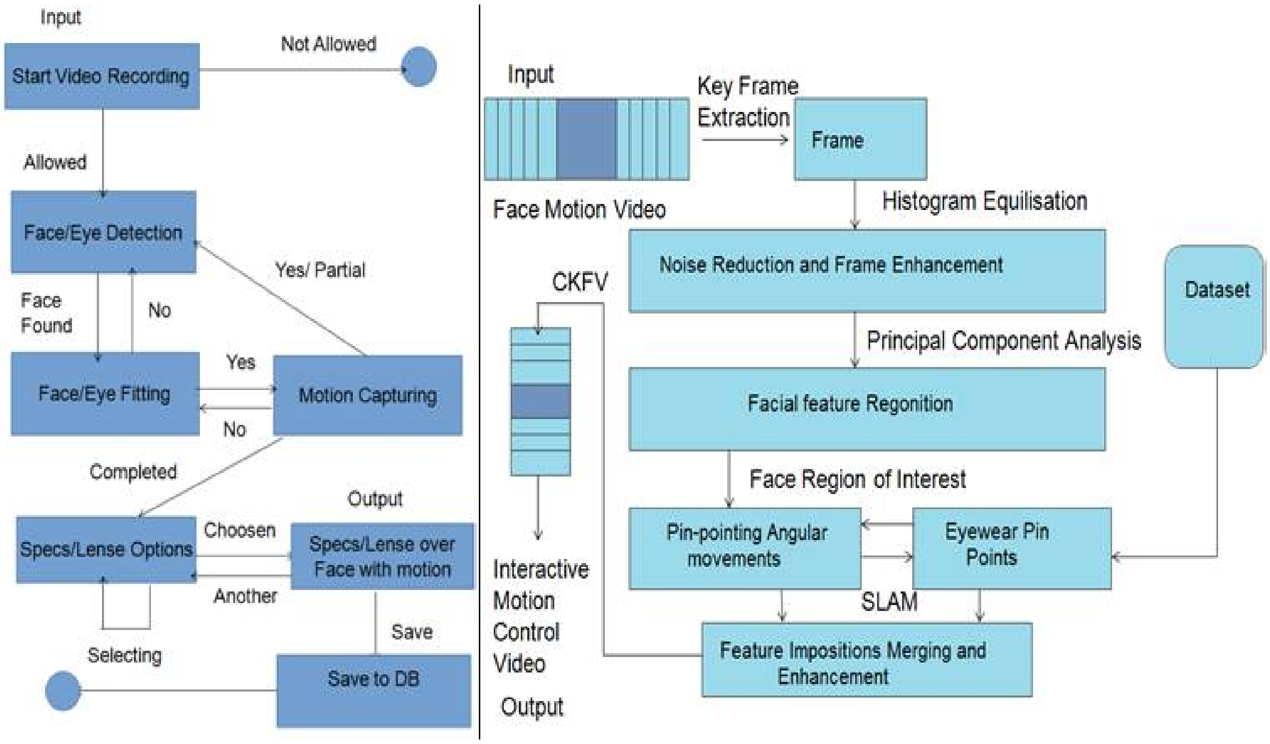

Fig.2. Architecture diagram of proposed system

The final output will show the eye-wear on human face that too in motion with proper left and right angular movements.

Realistic eyewear try outs are in front of the mirror as it allows user to move the face as desired and see the outcome at on mirror. To create the mirror experience the simulation is added to the final video. So that user can control the movements through the motion. Currently the motion is conveyed using mouse. But this can be extended later to the six-sense technology that is to react with human face motion. But this is for far later extensions requiring some markers on the face.

IV. CONCLUSION

This application will definitely be helpful for the customers shopping online to buy the eye-wear products after trying them, thus reducing the overhead of returning the products if it does not fit them or if they are not satisfied with the products. This application will ensure the online customers to buy for a desired and satisfiable product. Taking into consideration the advantage of Augmented Reality experience, it is possible to provide the solution using less infrastructure within a near real time and with near real experience. This application will be a step towards enhancing the Virtual Reality experience of user while shopping from an e-commerce site. Further, it can be used in real-time gaming. This application will be a big step towards enhancing the Online shopping trends with the help of Augmented Reality concept.

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