PYTHON OPENCV IMPLEMENTATION OF AN ONLINE VIRTUAL TRIAL ROOM

Pavan kalyan S N
department of computer science and engineering
East Point College of Engineering and Technology
Bangalore, India

Rashmi T V
Department of Computer Science and Engineering
East Point College of engineering and Technology
Bangalore, India

Thejashwini V
Department of computer Science and Engineering
East Point College of Engineering and Technology
Bangalore, India

Kishor Reddy Y S
Department of Computer Science and Engineering
East Point College of Engineering and Technology
Bangalore, India

Abstract— In the 21st century, clothing choices may vary based on factors such as height, gender, social status, and geographic location. While traditional in-store shopping remains the custom for many people, trying on clothing in real-time can be a time-consuming process, particularly when there are limited changing rooms available. To address this challenge, we propose creating a virtual system that allows customers to select from a wide range of clothing designs and then see how those outfits look on virtual models. This approach can help to streamline the process of selecting clothing, as customers can try on a variety of items without physically wearing them. The benefits of this system include reducing the need for customers to try on every item of clothing and enabling retailers to save time and space by not having to keep a large inventory of physical items. Overall, this project has the potential to enhance the shopping experience for customers and improve market management for retailers.

Keywords *— Virtual reality, Haar cascade Algorithm, Augmented reality*

Introduction

The world we are in today consists of two parallel universes: The real world and the virtual world. With the advent of computers, humans began to operate digitally and have been working towards seamlessly integrating the digital and virtual worlds ever since. As a result, numerous technologies have been developed to bridge the gap between the virtual and physical worlds. Such as virtual reality, augmented reality, and mixed reality.[10].

The rapid growth of the technology development industry has had a significant impact on our daily lives, with smart technologies streamlining our activities. For example, online purchasing has become a popular means of buying goods, offering convenience and accessibility. However online clothing shopping has the drawback of customers the decision to purchase is often influenced by how the business application being discussed follows all SMART rules of the organization, as outlined by N(2000). Additionally, the product is realistic and time-based. Initial work has been completed on correlating the design item with the human body virtually item's looks and feels when worn. To address this issue, there is a growing need for virtual dressing rooms that can imitate the visual aspect of dressing. Virtual dressing room offers a more time-efficient and accessible means of trying on clothing, particularly for online shopping. However, one of the challenges in establishing such a setting is aligning the user and the cloth models with precise location, scale, rotation, and order. To solve this issue, various methods for body component detection and posture assessment have been proposed in the literature. Web cameras are also increasingly being used to help users manage costs system does not accurately map dresses along the body object. To achieve a more realistic display and ensure user satisfaction, it is important that the system accurately fits dresses to the body object [7] in 2017.

In summary, the development of technology has brought about a close integration of the digital and virtual worlds, resulting in numerous devices that enable users to experience both simultaneously. Online purchasing has become a popular means of buying good and virtual dressing room offers a more time-efficient and accessible means of trying clothing. However, challenges still exist in aligning the user and cloth models which are being addressed through various methods proposed in the literature virtually map the fashion fabric onto the body object, resulting in a realistic display.

2. *Literature Survey*

Implementation of Virtual Fitting Room Using Image Processing by Srinivasan K. Vivek S. Department of Electronics and Instrumentation Engineering, Sri Ramakrishna Engineering College Coimbatore, India

The virtual Dressing Room technique for virtually dressing a person requires separating the person from the background while considering changes in lighting and the least amount of disruption to surrounding items. Following this, a Laplacian filter is used to detect the contour of the upper and lower body, followed by edge detection. Following that, feature points are extracted based on the fundamental human anatomy. The sample shirt is bent to precisely suit the person using this location as a guide

Image Processing Design Flow for Virtual Fitting Room Application used in Mobile Devices by Cecilia Garcia,Nicolas Bessou, Anne Chadoeuf and Erdal Orklu, Department of Electrical and Computer Engineering Illinois, Institute of Technology Chicago, Illinois, USA

This work successfully created a mobile device application for a virtual changing room. The primary goal of creating a real-time, platform-neutral application was accomplished. Users can choose from sizes XS to XL, move the clothing with the arrow buttons, and, if necessary, change the width of the clothing with the scroll button. They can also decide to experiment with various items before taking a photo of themselves to show how the clothing fits. The program can monitor the user's position and movement while tracking and scaling the apparel. Retail businesses can use this app by releasing it to the Apple Store or Android Market.

A Virtual Trial Room using Pose Estimation and Homograph Kshitij Shah, Mridul Pandey,Sharvesh Patki, Radha Shankarmani. Department of Information Technology Sardar Patel Institute of Technology Mumbai, India

The development of a mobile application that allows users to virtually try on clothing utilizing open CV and Tensor Flow lite technologies would greatly improve the shopping experience. AL suggested a solution that would align the input fabric on the person representation using a Geometric Matching Module. The Customers then uses the smart phone application to digitally try the clothing on. Using OpenCV, which first recognizes the customer's body and then maps the garments on to it, the mapping of the clothes is carried out. The clothing is kept on a fire base. The picture is kept in the gallery for further viewing.

3.*Algorithm Used for;*

3.1 Image detection

The approach proposed for the system involves acquiring dynamic video using a webcam. The video is then processed using a Haar cascade classifier to detect different parts of the body, such as the head, face, eyes, and lower body. A skin detection algorithm is then employed to further refine the detection process.Next, the distance between the camera and the subject is estimated to adjust the operational distance. This helps ensure that the dress model is accurately superimposed on the subject. The model of the dress is then scaled to fit the subject.

The Haar cascades classifier is a technique used for detecting faces and lower bodies in the proposed approach. The face is an important entity for detecting the presence of a subject within the operational frame. Haar cascades employ various types of contrast to detect parts of the body easily.

Current techniques for virtual dressing rooms rely on the use of Kinect sensors, which can be expensive. To introduce a cost-effective solution, we propose a scheme that uses the Haar cascades algorithm in combination with a skin detection algorithm to provide precise fitting of dresses on customers [6],[9].

After detection, dresses will be mapped onto the body using a mapping algorithm. This algorithm predicts the locus from which the read originates and gives the best possible fit of the dress on the body. The mapping algorithm helps determine the

general constraint satisfaction problem, resulting in the finest outcomes.

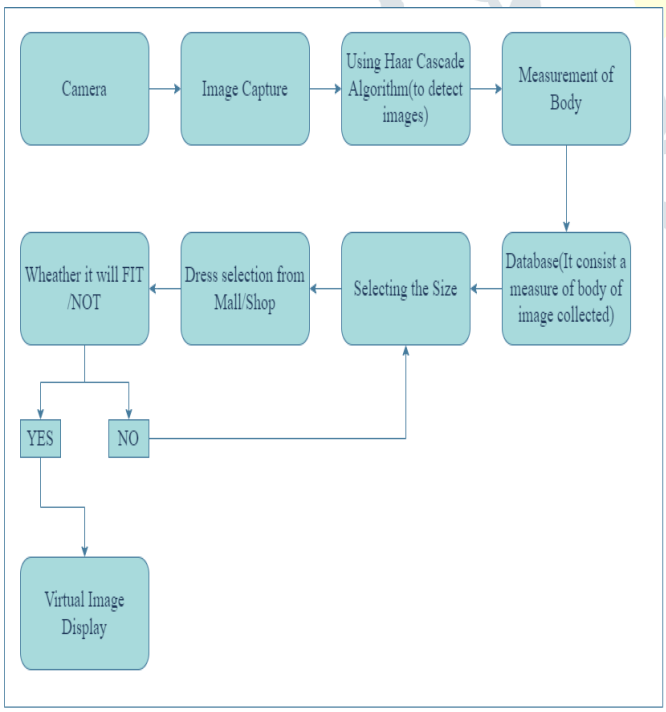
To adjust the size of the dresses dynamically, we use Euclidean distance. This technique adjusts the size of the material based on the measurement of the body, ensuring that the subject gets the desired result through the camera.

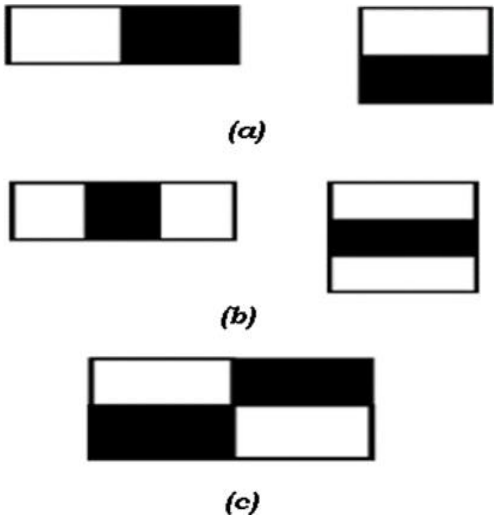
Our project allows customers to pattern their dresses with ease and affluence.

Haar classifiers are utilized for lower body detection in the proposed approach. These classifiers are also used for detecting features such as eyes, face, and body in Images containing moving subjects. Positive and negative image samples are incorporated into the haar classifiers and saved as . XML files[2].

Open CV utilizes various cascades, such as Haar cascade upper body, Haar cascades lower body, Haar cascades full body, and Haar cascade frontal face, to detect humans. The Haar method uses a Region of Interest (ROI) based on the Haar Wavelet Technique for pixel analysis in squares. This training data uses machine learning techniques to achieve higher degrees of accuracy. The concept of an "integral image" is used to estimate properties for the ROI.

Haar cascades use the Ad boost learning algorithm to select some key features from a large set, which is then used by the classifier to detect the target feature.





Edge Feature

Line Feature

Four Square Feature

Figure:1.1 System Analysis

System design is the process of creating a plan for a software system that meets the needs of its intended users. This includes designing the architecture, which is a visual representation of the system's components and their relationships, as well as the interface between them. The architecture provides a blueprint for how the system will be built and how its various parts will interact.it is an essential step in the software development process, as it helps ensure that the final product will be functional, reliable and scalable.

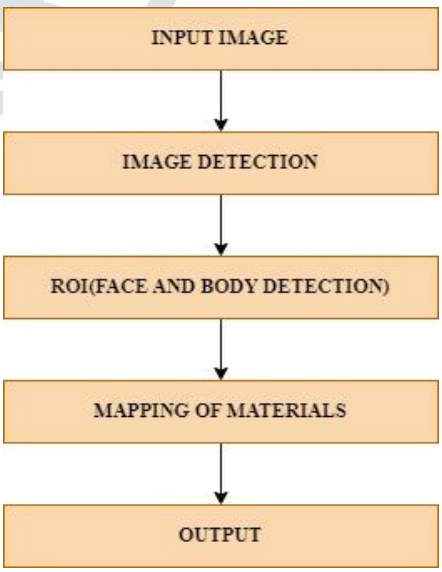


Fig1.2: Flow Chart for Face and Body Detection

3.2 Skin Color Detection:-

To maintain the novelty of the product, a skin color detection algorithm is needed to identify skin pixels in the detected faces and lower body parts. This algorithm will ensure that all body parts are fixed into the desired dress with a net-zero difference. To accomplish this, the RGB image is transformed into the YCbCr color space. This color space discriminates dominance from the intensity channel. The Y channel contains luminance information, while the Cb and Cr channels contain dominance information. Cb and Cr represent the blue and red color differences concerning a reference value, respectively. The Y channel has a range of 8 bits between 16 and 25, while Cb and Cr have a range of 16-240. The transformation equation from RCB to YCbCr is given by Equation A.

Due to the variation in skin color among different individuals, a threshold range is established to cover all types of humans, including Asians, Europeans, and others.

A histogram technique is used to segment skin color pixels within the video frame, which results in the discrimination of skin pixels using an optimal threshold. The resulting threshold value is then used for the classifier or filter stage.

The Skin Pixel quantifier is used to count the number of pixels with human skin to estimate the percentage of skin pixels and segment them out.

The region of interest (ROI) is the bounding box that shows up in real-time on the subject. This ROI image is obtained through detection using a Haar classifier, and the bounding box is shown on the body. The dresses are then mapped onto the subject using a mapping algorithm, which is applied to the body after proper detection. This mapping process produces the desired result based on the measurements of the subject's body.

3.3 DISTANCE CLASSIFIER TECHNIQUE

To estimate the dynamic distance between the camera and the subject, the Euclidean distance is utilized. If the distance between the subject and the camera is significant, the system automatically rescales to adjust the dress on the body precisely. This method was proposed by Hemant ET AL. in 2017.

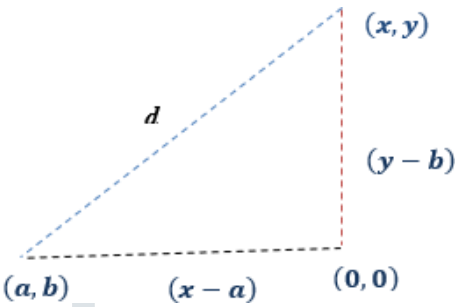
The formula for Euclidean distance is as follows:

$$\Delta s\big((x,y),(a,b)\big) = \sqrt{(x-a)^2 + (y-b)^2} \quad (1)$$

The Euclidean distance formula is used to calculate the distance between two points in a plane or 3-dimensional space.

Δs The formula is based on the Pythagorean theorem and is considered the most precise and reliable way to estimate the distance between two points. The formula for calculating Euclidean distance involves the coordinates of two points, denoted as x and y for the camera centroid a and b for the subject centroid, respectively. represents the distance. To estimate the distance between two points, we have defined four points as x, y, a, and b. The Euclidean distance can be computed using the following formula:

$$\sqrt{(x-a)^2 + (y-b)^2}.$$



4.Implementation

4.1 POSE ESTIMATION:

In the proposed approach, the Open pose algorithm is utilized to detect the human body parts in the input image or video. This algorithm detects the different parts of the human body and connects them using lines and ellipses to form a skeleton that represents the pose of the person in the input. This skeleton structure is then used as a reference for both the Segmentation and Try-on modules. Kshitij Shah, Mridul Panday, Sharvesh Patki, Radha Shankarmani,[3].The resulting pose, displayed on the input image or video, provides a visual representation of the detected human body parts and their respective connections. This approach enables the precise detection and representation of the human pose, which is used in subsequent steps of the virtual dressing room system.

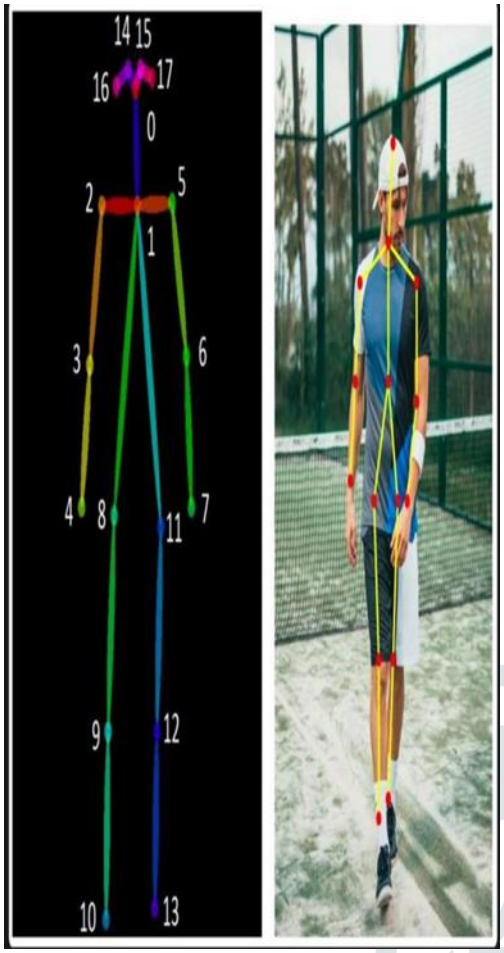


Figure 1.3 Sample Pose Estimation

The module starts by using argparse to parse the command line arguments, including the input path, threshold value, width, and height of the image or video frame. It then defines a dictionary of body parts and a list of pairs of body parts that will be used to draw the skeleton on the detect pose. OpenCV is used to read a pre-trained Tension Flow model for detecting human poses and then applies the model to the input frame to get the output heart map. The module extracts the highest confidence points from the heat map for each body part and connects the points to draw the skeleton drawn. This process allows for accurate detection and visualization of human poses in images and videos Srinivasan K. Vivek S [1]

Implementation is a critical phase in the life cycle of a computer system. This is where the system's design is translated into code, software, or other types of computer systems, effectively bringing the concept to life. The goal of implementation is to create a functional module that is robust, reusable, and expandable.

The implementation phase is the final stage of software development, and it is crucial in ensuring that the system is fully functional and meets the needs of the end user.

Implementation involves guiding the customer through the process of purchasing and installing the hardware or software, including user regulations, training, system integration, customization, scope analysis, and delivery.

Effective implementation is essential for ensuring that the system is fully operational and that end-users are satisfied with the product. By following a well-defined implementation process, developers can create a system that is not only functional but also calculable and adaptable to meet changing needs.

4.2 Pseudo code

Pseudo-code is a colloquial term for a high-level, informal description of how an algorithm or computer program works. Although it follows standard programming language structural conventions, it is written for human rather than machine reading. It is used to develop a program's rough draught or blueprint. Pseudo code condenses a program's flow but omits supporting information. To make sure that programmers comprehend the specifications of a software project and align their code correctly, system designers create pseudo-code.

4.3 Segmentation Approach

For this, we initially needed to be able to implement a segmentation algorithm. Even though open-source state-of-the-art models could have been used to implement this, we stuck with robust image processing techniques for segmentation. The idea is to localize the face and understand the skin color of the model from the face image to be able to divide an image into hair, clothes, skin, and background.

4.4 Geometric Matching Module

Once we have the clothing segment, we can now geometrically compare this clothing segment to the in-shop clothing. Our goal is now to be able to learn transforms on the in-shop clothing to make it geometrically similar to the model clothing. To visually describe this one can refer to the image below. The example is a grid of six images. The top left is the in-shop clothes, the top right is the clothing segment of the model, and the top middle is the transform (bottom left) applied to the in-shop clothes.

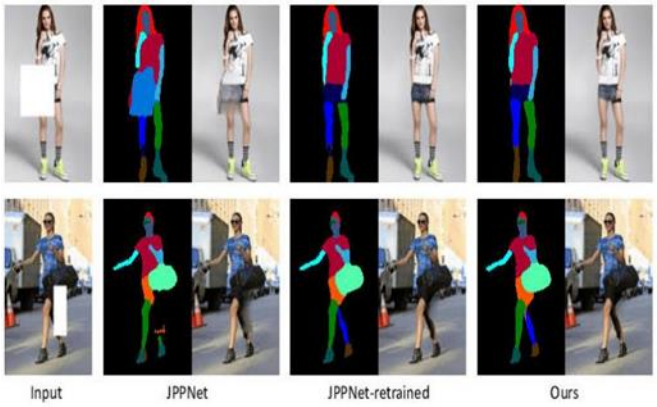


Figure 1.4 Human parsing

Figure 1.5 Expected Output

5.Results:

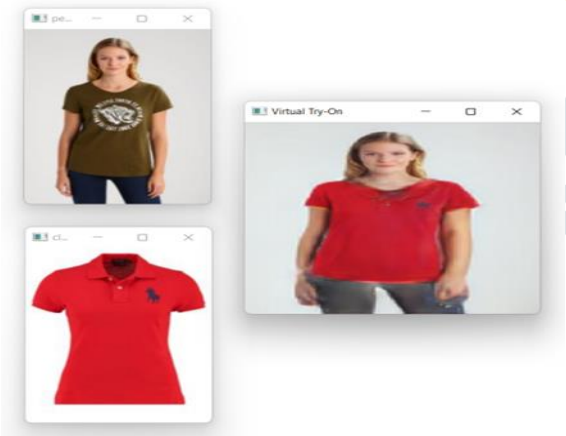


Figure 1.6 Final Virtual Output

Conclusion

The increasing popularity of an online shopping and the desire to make the most of it has led to the demand for an algorithm that can analogue dress group in their chosen clothing. Conventional physical try-on can be time-consuming and debilitating, with restricted time available for store to try on a scope of outfits. To address this issue, a virtual dressing room that functions as a trial room using a live video feed has been Projected and mapped, and this information is then used to create an image of the clothing over the user's body, annihilate the need for physical fittings and saving time.

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