Abstract

This project implements a real-time virtual trying of apparel on systems designed for the growing trend of online shopping. The major purpose of this product is to enhance the user's shopping experience by using the system, so they can know how the selected apparel will look on them before they make the online purchase. This study proposes a real-time 2D virtual model control and a virtual dressing room application to enable users to try virtual garments and shoes on in front of a virtual smart mirror (Laptop in our case). A virtual representation of the user appears in a virtual changing room and the user's hand motions select clothes from a list on the screen. Afterward, the selected virtual clothes appear on a humanoid model in the virtual mirror. User has to adjust the cloth from the position they are in to fit their size. The adjustment is done by cardboard with a large circle on it. Based on the circle radius, we make changes to the size of the cloth to fit with the user. Once the size of the cloth fits the user body then, the position is locked which makes the experience of virtual dressing smoother.

Introduction

Shopping for clothes online has obvious drawbacks. The selling items are inaccessible to the customers, so it is impossible for the customers to physically try on the clothes on themselves until the items are delivered. Customers always make decisions according to the pictures of models online. However, items look good on models does not imply they look good on the buyers as well. Therefore, the inaccessibility of purchasing items at selection time potentially increases the rate of item returns as a result of poor fit.

To conclude what has been observed online shopping has unavoidable limitations which give rise to customers' unsatisfied shopping experiences as well as the retailers' losses of potential sells. In order to deal with the "lose-lose" situation, people are keen on looking for strategies and techniques. Then, an idea called "Virtual Dressing Room" is put forward. Customers would be able to perceive the visual image of how they look like by trying on clothes virtually so that they can easily filter out some selections without taking turns to use the fitting rooms. Compare with the Physical dressing room, "Virtual Dressing Room" takes much less time. Thus, it increases the shopping efficiency for all customers, hence, enhances the shopping experience.

This project report describes an interactive visual computer system called "Virtual Dressing Room" which implemented the concept of "Virtual Try-On" with the help of a script written with Python programming language and OpenCV library. A virtual dressing room (also often referred to as a virtual fitting room and the virtual changing room although they do, on examination, perform different functions) is the online equivalent of an in-store changing room. It enables shoppers to try on clothes to check one or more of size, fit or style, but virtually rather than physically. [1] The following sections give further details about this project in terms of its objectives, related works, system design, development tools, implementation iterations, evaluations, and feedback.

Objective

Virtual Dressing Room is an interactive system that mimics the real fitting experiences. Displaying the user's whole body image is a practical concern. Unlike a usual user interface, the screen requires a large portion of center space to display the user's mirror image. Then, the remaining part of screen should be utilized effectively in order to display other information, such as instructions and functional menus.

The main objective of this project is to build a virtual system where e-commerce users or customers could try out clothing items before they make their purchases without trying on the clothes for real. In this way, the user can try out clothes quickly and easily which can improve their decision process and saves their meaningful time as well.

Related Works

There have been several types of research in the field of Virtual Dressing Room. Early development of the virtual dressing room has been already done by Fashionista using Kinect 3D by Microsoft. [2] Since, the release of ARCore and ARKit, It has been easier than before to develop a virtual dressing room. However, VDR hasn't been commercialized yet.

Requirements

The basic requirements of this system can be broken down into multiple types, functional and nonfunctional.

Functional Requirements:

- Show the customer how the clothing will look on them
- Resize the clothing according to the size selected
- Recognize the primary user in case of multiple people in the frame
- Show the image in a real-time system.
- Allow users to navigate through multiple products.
- Calibration of the clothing size required for the user.
- Capturing of the fitted tryout for sharing options.

Nonfunctional Requirements:

- Scale/Shear the product according to body posture and position.
- Clothe recommendation system according to the type of skin color tone and body structure of the user.
- Navigation of products through hand gestures.
- Sharing of the captured tryouts on social media.
- The realistic output of the system

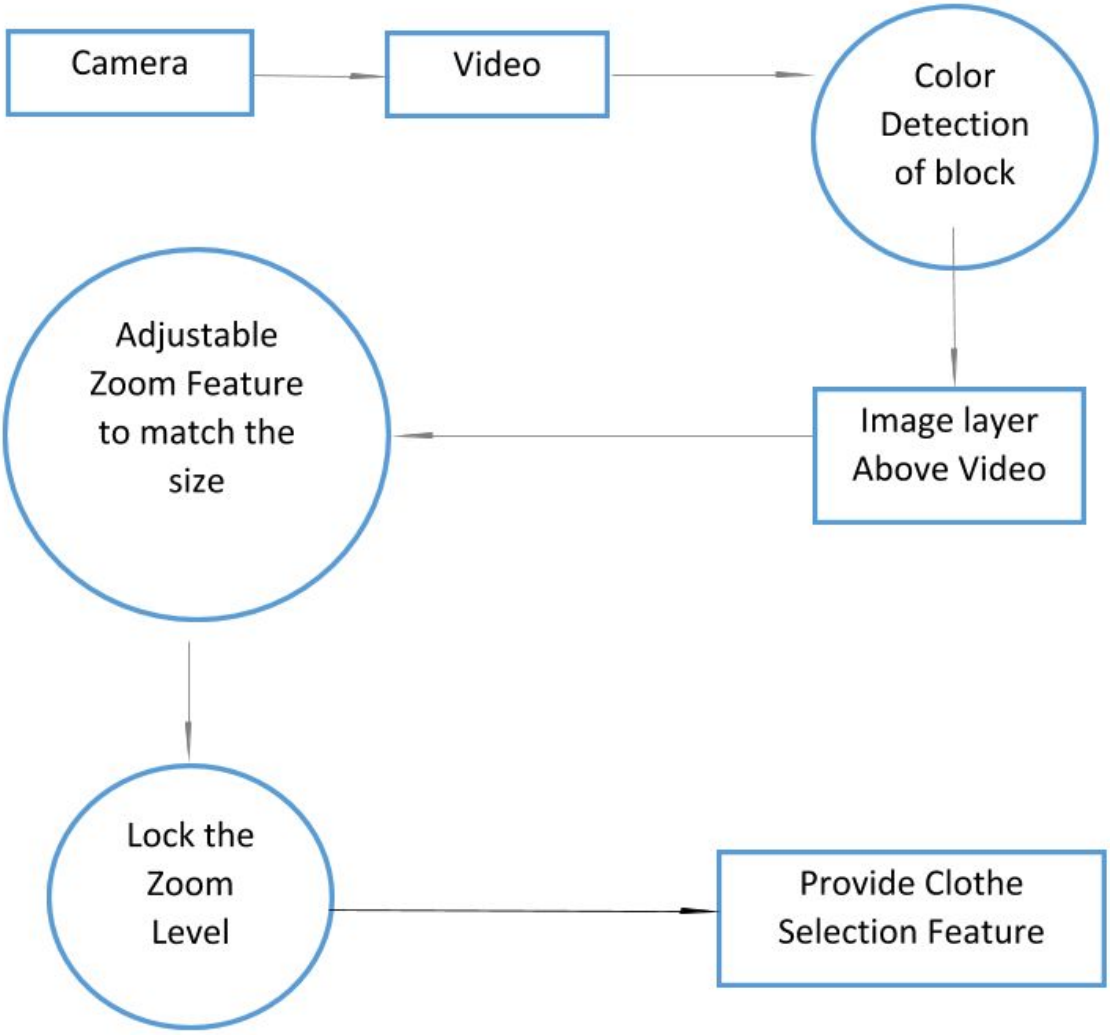
Literature survey

Upon doing extensive research on the development of Virtual Dressing Room or other such projects done so far, we came across a relatively fewer number of results as this topic has been a research topic for a decade now. However, we did come across a few amazing projects done similar but with the use of advanced hardware and complicated programming which made such surreal experience come alive on a better scale.

All of the projects we came across had made use of the Microsoft Kinect, which is basically a depth sensor camera used for the accurate 3D tracking and positioning. In the lack of such sophisticated hardware, we had to make use of the smartphone cameras to generate the virtual experience which leads us to what we have developed in this project. What we came to know that smartphone cameras are not a reliable source for this kind of stuff as the object tracking was not reliable from this camera.

Implementation and Methodology

The implementation of this system is on the growing trend of online apparel shopping. Since it makes use of minimal components, this system can easily run on any system and is very convenient to use



This library contains different blocks which describe the working of the library:

Video Block

This is the first process to try Virtual Dressing Room. A Webcam is used to capture video. The Video from the camera is processed and some UI is integrated with the same video screen where users could try the outfit.

Color Detection Block

To enhance the adjustable zoom feature, a solid colored block is taken by the user and moved back and forth. The color of the block is detected and processed and the outfit is placed at the portion of the colored block. The image of the outfit is placed above the video and the zoom level can be adjusted moving the colored block.

UI Controller Block

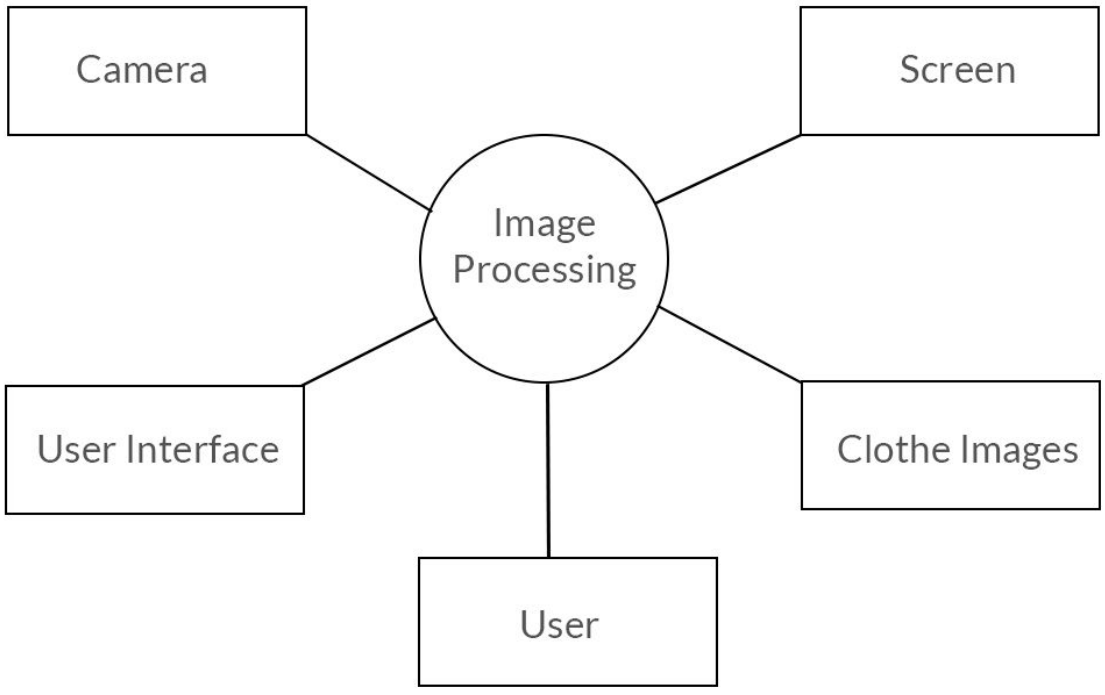
At the screen, users are provided with different UI components that the outfit they are trying. Users could simply use Hand Gestures to control the UI Components. The Gestures are detected by processing the video and the position of their hand is detected. If the position of their hand is overlapped to the UI components on the screen, it is said to be clicked and respective actions are taken. The UI Components include:

- Locking the zoom level to adjust the position of their outfit.
- Previous and Next buttons to quickly navigate to the previous and next outfit.
- Color Selection Buttons to quickly select colors of the outfit.

Recommendation Block

Since the interests and colors of a user are similar, this library could be implemented to recommend colors and outfits for the user. This feature can be achieved by the Machine Learning approach. The selections and trials of a user are continuously used to train the machine to recommend users the colors and outfit they are interested in.

Data Flow Diagram



System Feedback

We tested the Virtual dressing room with our colleagues and friends to collect the feedback for the usefulness, ease of use, ease of learning and satisfaction.

After the scenario task walkthrough, six evaluators are asked to fill the other questionnaire to evaluate the usability and satisfaction of the Virtual Fitting Room system. Figures 1, 2, 3, 4 and 5 are the distribution results that measure the system usefulness, ease of use, ease of learning, satisfaction and overall scenario evaluation respectively.

Usefulness

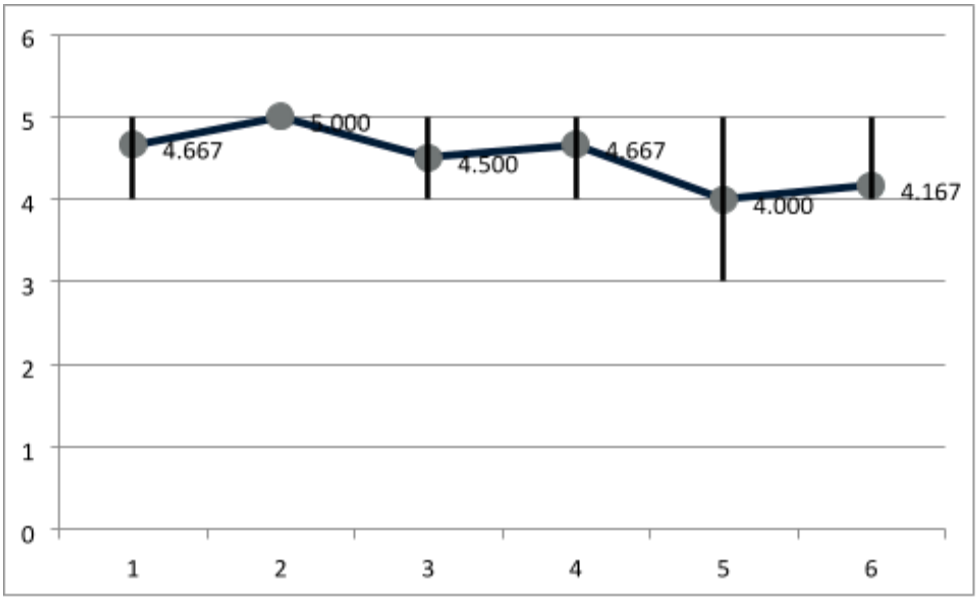
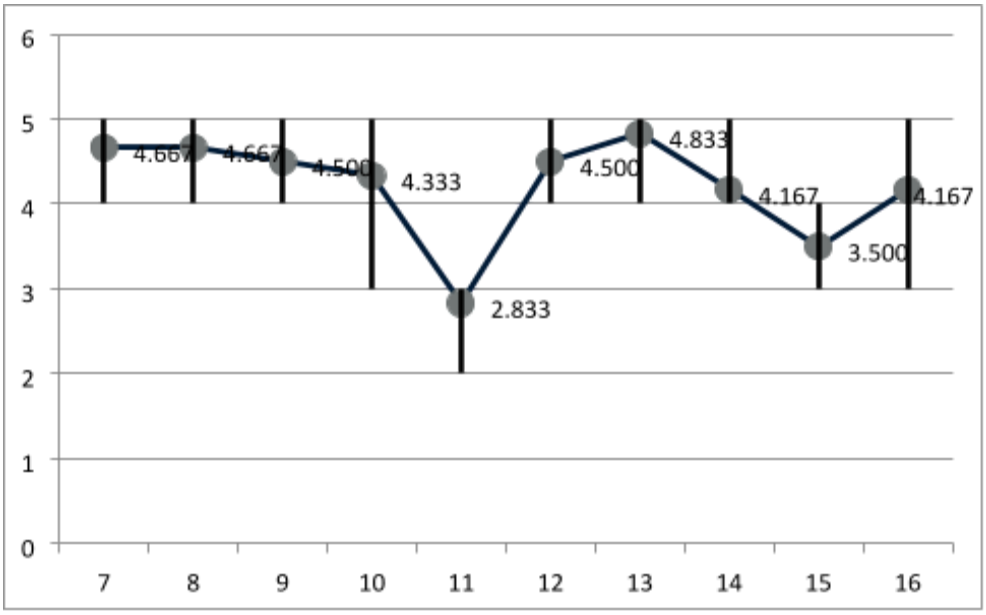


Figure 1 measures the system's usefulness. The average score of each question reaches 4.0 or above, which shows that the Virtual Fitting Room system is useful and meets general users' needs.

Ease of Use



The user-friendly interface made it easier for users to make use of the system easily.

Ease of Learning

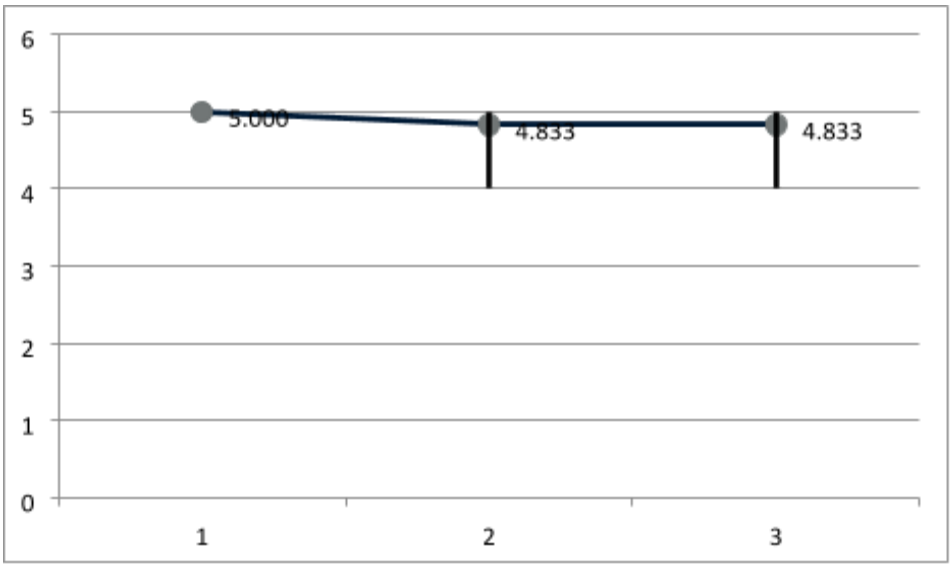


Figure 2 shows the measurement of ease of learning. Because the system features are not complicated and the gesture used is intuitive and straightforward, the system is very easy to learn.

Satisfaction

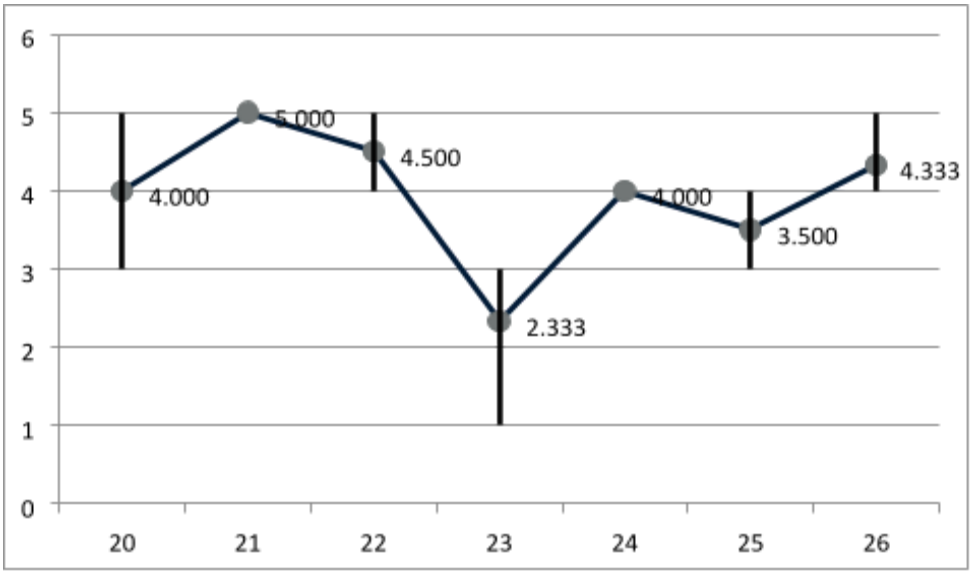
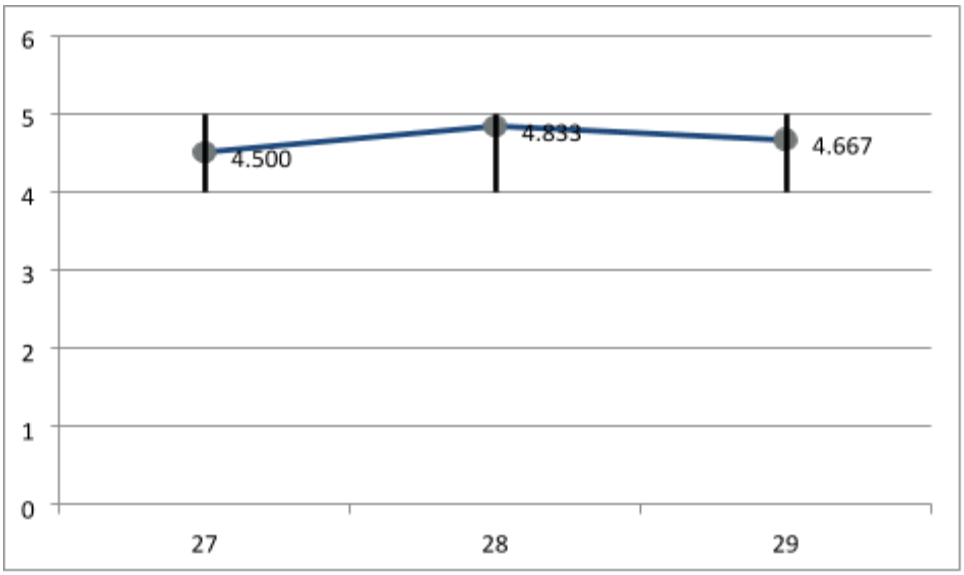


Figure 3 shows the evaluation of system satisfaction.

Overall Scenario Evaluation



The overall scenario evaluation is given by Figure 4, and the results indicate all the evaluators are quite satisfied with doing the scenario tasks using the Virtual Fitting Room system. That is, the features of the Virtual Fitting Room system are quite satisfied by general users. Hence, the project objectives are achieved.

Limitations

Although being a product that can hit the market, the system has the following limitations:

- Not being able to render the realistic experience
- Not much effect on the current context due to lack of necessary components and set of skills.
- Not much customization options for the users.
- Not being able to generate contents quickly and effectively due to lack of hardware

Future Enhancements

We propose a novel virtual fitting room using depth sensor data. The framework yields a realistic fitting experience for standard body types with customized motion filters, body measurements, and physical simulation. The proposed scaling method adjusts the avatar's body size parameters and determines a suitable apparel size, and prepares the collision mesh and the physics simulation, within a total preprocessing time of 1 s. We apply real-time motion filters that prevent unnatural artifacts by smoothing the depth sensor data and estimate the locations of self-occluded body parts.

The most important limitation of the framework is its insufficiency in customization. In its current form, it provides a realistic fitting experience for standard body types. For example, for the obese woman that we experimented with, although she has a greater overall body width, she still has a very well-defined waist, which is not realistic for obese people in general. This can be overcome by using more parameters such as waist width. We also expect to be able to get better input quality with advancements in depth-sensing technology, hence providing a more realistic experience by increasing the precision. Another limitation is the small simulation zone, which limits the user from seeing the cloth while walking and during other motions. This limitation can be overcome by introducing multiple calibrated sensors.

In future work, we would like to improve the quality of the measurements and visual scaling by using data from an RGB sensor as well, because it provides additional data. We would like to increase the number of collision spheres for

better collision detection. The virtual mirror application is the part of the next-generation technology. [3]

Conclusion

Thus with constant research and numerous iterations, a working prototype of the system was developed well enough to create a virtual room for the users to allow them to virtual tryout the selected outfit. In this study, a virtual mirror system is designed for the purpose of the clothing changing room. Our motivation here is to increase the time efficiency and improve the accessibility of clothes try-on by creating a virtual dressing room environment.

The system contains two basic male and female models of which joints are over 200. They have the spectacular potential of performing human movements as well as facial expressions. For body size and height, we created a lot of model variations. The GUI of changing-room reads and interprets the data arrived from keyboard, mouse, webcam or Kinect input units and enables users to try garments and shoes on a created humanoid model.

References

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