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Advanced Virtual Fitting Rooms: A Review of Underlying Artificial Intelligence Technologies and Augmented Reality

Sheik Imran[1], Rekha C[2], Reshma C R[3]

[1]Assistant Professor, Department of Information science and Engineering, Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India
[2]Associate Professor, Department of Information science and Engineering, Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India
[3]Technical Trainee, First American India, Bengaluru, Karnataka, India

Abstract: ***This paper analyzes the current state of biometric data privacy laws in the US, EU, and India, and how they affect the use of AR technologies in the retail fashion industry. One section of the paper focuses on how retail fashion stores use AI algorithms to offer enhanced interactive features in virtual try-on mirrors. Three-dimensional (3D) models are simulated in real-time using augmented reality (AR) and artificial intelligence (AI) technology in virtual changing rooms. Your business or organization can depict characteristics of any person, including gender, size, fit, and shape, using virtual dressing room systems that use three-dimensional (3D) models. In order to create a virtual fitting model using previously provided images, the system obtains information about custom body sizes. The system then displays the fitting effect after the model has tried on several different costumes. Augmented Reality Virtual Dressing room works by superimposing the model or picture of a garment or accessory within the live video feed of the customer. The customer's movements will then be tracked by the model or image of the clothing or accessory that is superimposed, giving the impression that the consumer is wearing the virtual item in the video view. Additionally, ubiquitous social networking capabilities enable sending images or videos of the customer wearing the item for prompt feedback.***

Keywords: Augmented Reality (AR), Virtual Environment (VE), Virtual Reality (VR), Artificial Intelligence (AI), Virtual Fitting Room (VTR).

1. Introduction

A subset of virtual environments or virtual reality is augmented reality. The synthetic environment used by VE technologies totally replaces the real world. The user is unable to view the surrounding real world while immersed in the artificial environment. Contrarily, AR enables users to view the real environment with virtual things superimposed or blended in with it. Thus, rather of entirely replacing reality, augmented reality augments it. The user should see the real and virtual items as harmoniously coexisting in the same place. An environment that combines parts of the real world and virtual reality is called augmented reality. The three qualities of an AR system are as follows:

- They blend the real and the virtual.
- Real-time interaction is possible.
- They have 3-D registration.

The usage of merging actual and virtual items in 3-D makes augmented reality an intriguing topic. AI builds complete 3D representations of the shopper in front of the camera using algorithms and machine learning. It merges the physical environment with the virtual clothing put on it, which makes using augmented reality in a virtual changing room for online shopping highly intriguing.

2. Literature Survey

An environment known as a virtual dressing room gives customers the chance to virtually put on their clothes. As internet shoppers prefer to purchase goods online, they also want to view outfits in person. Additionally, many clients want virtual changing rooms for special occasions in order to save time and energy. It has been challenging for customers to purchase products and try on their favorite outfits in the fitting room due to the high client traffic in boutiques.

Over the past few years, digital technologies have played a significant role in the business and fashion industries. It greatly affects our daily lives. Information technology has changed the fashion industry by providing new opportunities for augmented reality and virtual reality. Due to its potential for commerce, virtual clothing try-on rooms have recently attracted a lot of interest. Customer satisfaction will increase as a result of the development of this cutting-edge technology in the fashion design sector, and this can economically benefit all online shops. Benefiting from technological improvements and a boom in artificial intelligence, VR and AR technology still has a ton of potential in a variety of fields.

The application is SMART-compliant and follows all business organization's SMART criteria (N, 2000). These Rules establish the business's management plan, and our product fully satisfies these requirements in terms of its specificity, measurability, and attainability. It is based on time and is more realistic. First steps have been taken to realistically correlate the design item with the human body so that the user can stand directly in front of the incorporated automated mirror. The method creates an accurate representation by electronically matching the clothing material to the body part. The system's inaccuracy in mapping the dresses along a person's body is a restriction of their work. The technology must precisely fit the clothes for a more realistic display that will satisfy the user. Kinects and RFID tracking are used in "I Fashion Clothing System" and

"Magic Mirror Coordination System" to identify customers in virtual dressing rooms.

Earlier, 3D models of dresses were created using computer-aided design (CAD) and then used as a tool with the Kinect sensor. Yaun and coworkers (2013). The magic mirror coordination system that suggested identifies the person and digitally analyses the bodily data. The user must manually place the desired clothing, makeup, and hairstyles by clicking on the appropriate button and choosing their favorite style [11]. Masri et al.'s (2019) description of a novel Kinect-based augmented reality concept for changing rooms. Their methodology takes into account 2D clothing, and the primary goal of the study is to extract body features by placing the Kinect sensor right on the body attributes, which is compatible with 2D clothing. [13] Virtual trial rooms are described by Fathima et al. (2019) utilizing "ShopAR" visual animations. A method was developed by Bhalekar et al. [12] that uses camera, motion, and light sensors to observe several attributes, including as height, skin tone, and hair color, to give a skeleton a flawless appearance. In order to measure the customer's body, Zaware et al. (2018) proposed a concept for a virtual changing room based on a smart phone and the Euclidian distance formula. Virnes et al. (2018) suggested methods for identifying the outfit's number, size, color, and other details in the changing room. Along with dress color, size, and type labels and price tags were also introduced for smart dressing rooms or computerized dressing rooms. Using augmented reality, Feng et al. (2019) developed a finger tracking technology that allows customers to customize their garments in a virtual dressing room. A 3D model and RGBD sensors have been employed. Young people were attracted by Chopra's (2019) introduction of artificial intelligence technologies like unity cross platform in virtual rooms employing augmented reality, and they flocked to use these cutting-edge AI Vrooms and make secure online purchases. In their study from 2019, Rosy et al. focused on how AR and VR will progress the fashion business in the coming years.

3. Proposed System

Utilizing AR and computer vision technology, the aim of this project is to develop an AR virtual fitting room app for smartphones. The suggested app is primarily based on the iOS mobile operating system. A smartphone camera is a requirement in order to recognize and track human body movements and interact in real time with suggested software items like virtual clothing.

The application's Graphical user interface (GUI) is designed to be simple and intuitive so that users of all ages may use it. The clothes catalogue, garment information, and camera preview are the app's essential and key user interfaces. User interfaces must be created and constructed utilizing heuristic principles that are easy to understand, effective, recallable, error-free, and entertaining in order to satisfy the usability criteria.

Additionally, the human body identification and motion tracking model from the AR core foundation is used to recognize and identify the human body's skeletal joint positions in real-time. The live footage is loaded into the model to produce a classification result.

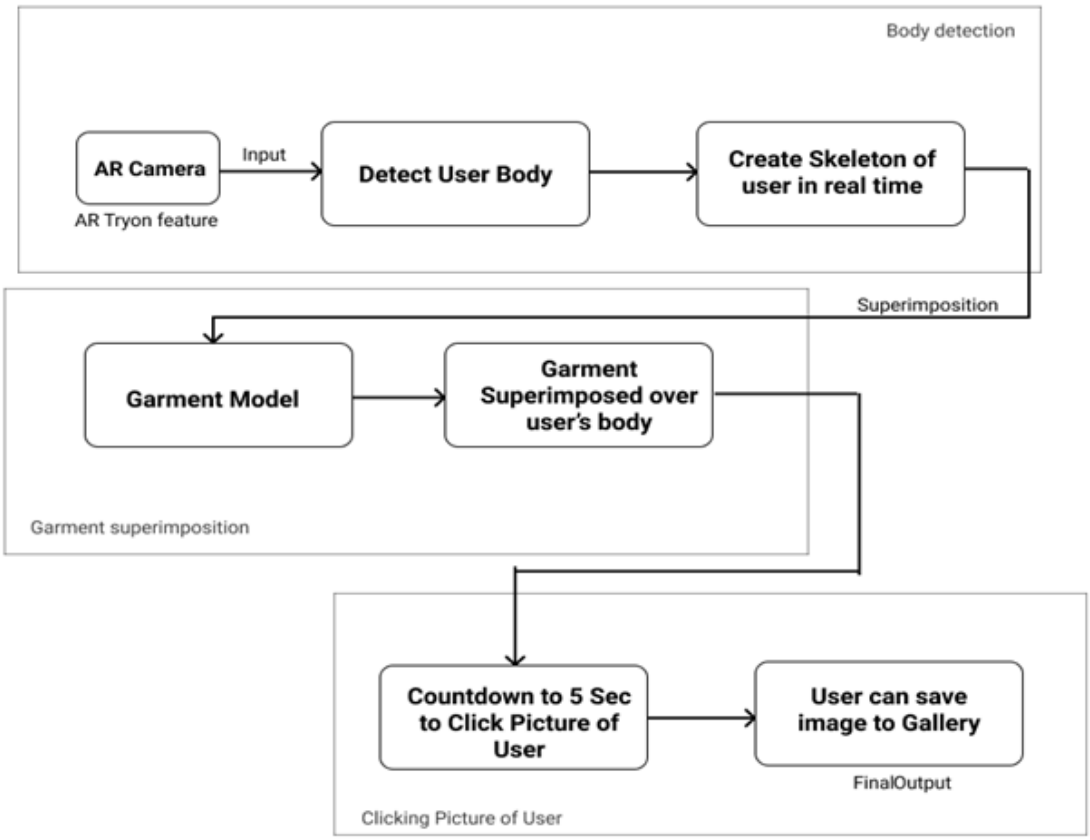

Figure 3.1: Block Diagram of the System

Additionally, the accessible apparel is transformed into models using body skeleton-based joints and outfit dimensions to enable real-time adaptation to the human body. Briefly stated, a human body identification and motion tracking model are being created in conjunction with an AR based virtual fitting room app for iOS.

4. Implementation

The AR kit uses a camera to identify and follow a person's motions. Real-time motion detection is applied to a 3D character model by Reality-Kit, which enables the person being filmed to manipulate the 3D model like a virtual puppet. This AR Anchor subclass follows one person's movements. By starting your session with the AR-Body Tracking Configuration, you can enable body tracking. When the AR kit detects a person on the back camera stream, it uses AR Body Anchor to contact your delegate. The world location of the body's hip joint is determined by the transform position of a body anchor.

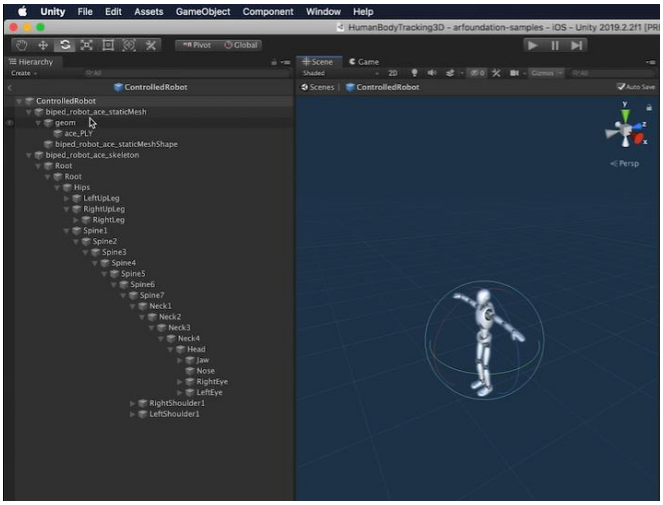

Figure 4.1: ARKit Layout

Import the given skeleton and the unique mesh model into your 3D modelling program (such as Maya, Cinema4D, or Modo) so that you may utilize them with the Motion Capture feature of the AR kit. Modelling your mesh in a typical T-pose is recommended. It's crucial that you set up your import settings to prevent any joints in the skeleton or the orientation of the loaded character from changing. The character should be imported with its left hand pointing along the +X axis, facing the +Z axis, with the top of its head pointing towards the +Y axis. Additionally, you need to set up your scene so that +Y is the up axis. This orientation necessitates modifying the default scene settings in several software applications.

Following that, align the mesh with the imported skeleton and scale, translate, and rotate it until it is as similar to the imported skeleton as possible. Lastly, freeze mesh transformations. Ensure that the X axis continues to point down the length of the bone after you've finished changing any armature joints that don't align properly with the mesh to complete the mesh-to-armature alignment. Numerous 3D software programs come with capabilities that allow joints to be automatically reoriented dependent on where their children are. After relocating joints to new positions, use the re-orienting feature if it's offered in your software program.

Binding of the mesh to the skeleton after it has been placed in the proper position. A maximum of four skin impacts per vertex is recommended for optimal performance.

Each joint in your hierarchy should have a rotational value that matches the values in the example skeleton that is provided, and your character should be modelled in a T-position with just one bind pose in your scene.

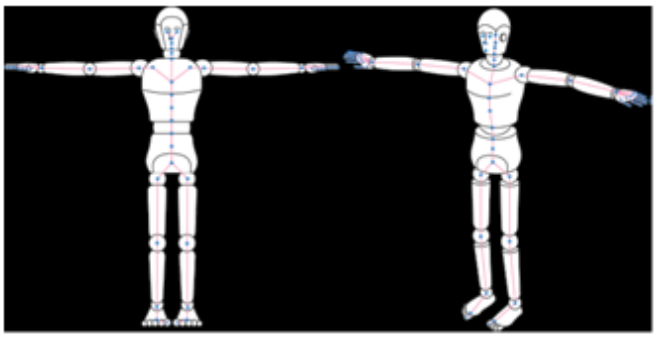

Figure 4.2: Character Model

Models must follow a certain format in order to use the body-tracking capabilities of AR kit. Models that don't follow the anticipated format may function improperly or not at all. We must check that your character's skeleton fits ARkit's anticipated joint names and hierarchy for motion capture, as well as that your character's scene coordinate system and orientation comply with ARkit's expectations.

Models' joints must precisely correspond to the joint designations specified in the AR kit. In addition, the layout of the AR kit and the relationship between joints must be the same. There is no need to link vertices to every bone in your skeleton, but it must have all the anticipated joints in the proper hierarchy. Even while the bones that govern the eyes must still be present in the skeleton of your character even if it doesn't need moving eyes, you may simply tie no parts of your model to those bones to negate their effects.

Figure 4.3: Body Tracking using 3D skeleton

Following the successful validation of our model for motion capture, we were able to produce the following result, in which the body was properly tracked and a 3D skeleton was created to simulate real-time human motion.

Figure 4.4: 3D Garment Model

The user's body dimensions, skeleton joint positions, and apparel measurements are then used to arrange the virtual apparel on the user's body.3D model of the outfit is required, which is made with Blender, in order to superimpose it over the user's body. By using a bone armature, which is both controlled by AR and the dress, we were able to connect our 2D dress model to a 3D dress model.

Figure 4.5: Garment Mesh

The virtual clothing can be smoothly adjusted to the user's body for increased realism. The virtual clothing checks that it is properly fitted to the user's body by tracking their movements using the smartphone camera and simulating them with realistic virtual movements. Based on the user's body movements, the virtual clothes will continue to appear as it would in a real-world view.The user interface and prototype were developed using the figma application.

Augmented Reality (2D, 3D) is a technology that expands our physical world by adding layers of digital information into it. Unlike VR (Virtual Reality), AR does not create an entire artificial environment to replace the original with the virtual. 3D fitting space uses computer-generated 3D images to create experiences similar to those seen in virtual world computer games. The 3D version itself uses information taken from a scanning device. Clothing is then displayed on a 3D avatar, which customers can personalize by uploading their own face images. Demonstration of a few UI screens are shown below.

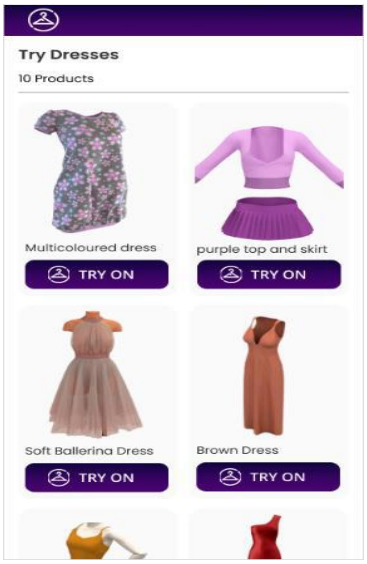

Figure 4.6: Environment/Shopping Menu

Environment is the place where the user wishes to place the product to get an AR Experience of what he/she is about to buy.

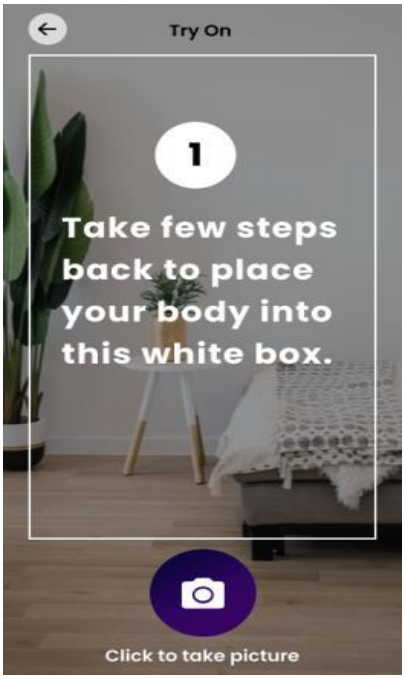

Figure 4.7: Try-On Interface

Using a webcam to visualize fitting rooms, a web-based application that applies the concept of augmented reality to display clothing objects in 2D, and 3D where augmented reality is a technology that combines two-dimensional and or three-dimensional virtual objects into an environment three-dimensional reality then project these virtual objects in real-time, with the final result of this application can be used to try out clothing and to change the size of clothes virtually.

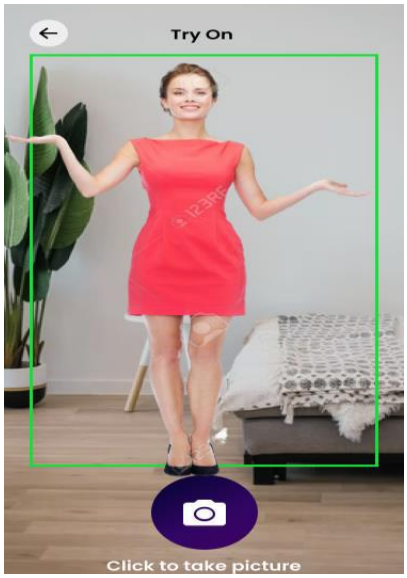

Figure 4.8: Body Detection

VFR is a technology that provides a virtual product trial experience through virtual model simulation based on consumer body measurements.

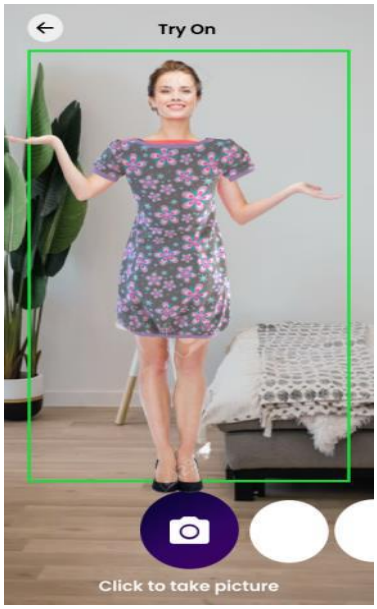

Figure 4.9: Final Result

The application represents the output of the framework, extracted from the picture (taken from the camera). If someone stands in front of the camera, that person will be able to choose the desired clothes. The choice of clothing is then superimposed on the image recorded by the camera.

Conclusion

In proposed system, AR framework and Unity 3D-based augmented reality provides try-on system for clothes. It tracks the user's body in actual time using the back camera of the AR kit, projected a 3D outfit over the user's body in real time, and allows the user to move around freely, turn to check the fit and color of the clothing, and snap pictures. AI is used to smoothly adjust to the user's body for increased realism.

Future Enhancement

New features can be used to improve user experience like,

- **Recommendation Systems:** which offers apparel suggestions based on a user's previous purchases or Wishlist.
- **Application on Android**: Mobile devices can be used which has open-source Android Operating systems.
- **•Motion Capture Systems:** Interact with the application's content by making hand motions.
- **Virtual Mirror Implementation:** Using a virtual mirror to display a virtual changing room app, which may be quite helpful in shopping centers and retail establishments. Even while the idea of online shopping is thrilling in and of itself, it could be even more so if we could see how a certain item of clothing would appear on us. The use of AR in our AR-Tryonapplication will make the entire shopping experience amazing. AR is the future of visualization.

References

[1] Hu Peng, Application Research on Face Detection Technology based on Open-CV in Mobile Augmented Reality, 2015
[2] Virtual Mirror: The Future of Interaction (https://medium.com/hackernoon/virtual-mirror-thefuture-of-interaction-95755b0d3d60)
[3] Miroslav Moroz, Tendency to Use the Virtual Fitting Room in Generation Y - Results of Qualitative Study, (Wroclaw University of Economics, Wroclaw, POLAND miroslaw.moroz@ue.wroc.pl)
[4] Virtual Clothes Fitting Application Based On Augmented Reality For Online Retailers, 2020
[5] Virtual Fitting Room by Zeekit (https://zeekit.me/)
[6] C. Garcia Martin and E. Oruklu, Human Friendly Interface Design for Virtual Fitting Room Applications on Android Based Mobile Devices, 2012.
[7] Yang Kuang, XiaoMei Bai, XiaoYa Zhou, A study of Camera Application Methods in Unity 3d, 2018.
[8] Buse Asena Koca, Burakhan Cubucku, Ugur Yuzgec, Augmented Reality Application for Preschool Children with Unity 3D platform, 2019.
[9] WebcamSocialShopper (http://webcamsocialshopper.com/)
[10] https://www.youtube.com/watch?v=cfKzUYH4i7A,
[11] Miri Kim and Kim Cheeyong, Augmented Reality Fashion Apparel Simulation using a Magic Mirror, International Journal of Smart Home Vol. 9, No. 2 (2015), pp. 169-178.
[12] Bhalekar Sourabh, Chitte Darshan, Dhamal Hemant, Ganeshwade Priyanka, Rankhambe J.P., “Implementation of Virtual Dressing Room using Newton’s Mechanics”, 10.23956/ijarcsse/SV7I5/0107.
[13] Syed Ali Fathima S J,Shankar S, Surendiran B, Saranya K, Advent of Augmented Reality Experience in Retail and Online Shopping and its Influencing Significance in Future,International Journal of Science and Technology, Volume 5 Issue 2, pp. 35-47. Date of Publication: 19th August 2019.