Augmented Reality based Virtual Dressing Room using Unity3D

Mrs. Jessica Dias
Assistant Proffessor, Department of Information Technology,
St. John College of Engineering and Management,
Palghar, India.
jessicad@sjcem.edu.in

Divya Chouhan
UG Student,Department of Information Technology
St. John College of Engineering and Management,
Palghar, India
divyach@sjcem.edu.in

Preshit Churi
UG Student,Department of Information Technology
St. John College of Engineering and Management,
Palghar, India
preshitc@sjcem.edu.in

Pranay Parab
UG Student,Department of Information Technology
St. John College of Engineering and Management,
Palghar, India
pranayj@sjcem.edu.in

Abstract*— The ever-changing fashion industry is always flooded with new trends that a lot of fashion enthusiasts like to try out on a regular basis. However, with the emergence of the covid pandemic, touching things in public places without feeling the need of sanitizing your hands has become a difficult task. Trying on new clothing at stores can be very difficult for people who are always conscious about their health in such times. This has caused people to turn to online shopping but it also brings the problem of clothes being too loose or too tight and users have to return them often before finding the right size. Our project targets this problem by introducing a virtual fitting room, in which the users can scan their measurements perfectly and browse different styles and see how they would look in those clothes using Augmented Reality (AR) technology

Keywords—Augmented Reality, Virtual Fitting Room, Online Shopping

I. INTRODUCTION

Online shopping has certainly replaced the traditional way of shopping for daily goods and clothing. When we choose online shopping, we get the benefit of credibility, cash on delivery, free shipping and discounted prices. These online shopping stores eliminate the hassles of parking, getting stuck in traffic jams and standing in long queues for billing. There is no doubt that these are some of the attractive features that catches the attention of the consumers. But trying on clothes at stores can be a time-consuming process. Furthermore, in some circumstances, such as digital shopping, there's no chance to be able to try on garments. The majority of people are said to avoid buying apparel online since they don't want to risk getting their sizes wrong. Furthermore, a substantial percentage of the things purchased are returned. Retailers and customers alike will face an additional financial burden as a result of this. By creating a virtual dressing room setting, we hope to improve the time efficiency and accessibility of garment try-ons. This program can improve the way clients purchase online by assisting them in selecting the proper type and size of apparel. The suggested technique is designed to be computationally efficient and can be used with existing smart phone devices, allowing consumers to shop for new garments more easily online.

II. LITERATURE REVIEW

"Application Research on Face Detection Technology based on Open Source Computer Vision (Open-CV) in Mobile Augmented Reality," Hu Peng et.al. [1], proposed in 2020. Face identification technology and mobile augmented reality are combined in this study to conduct research. AR Face Book is an interactive mobile augmented reality programme based on face identification that is developed on the Android platform using Open-CV and Qualcomm Augmented Reality (QCAR) as standard technology. The installation of crucial components in the application development process is also discussed. Despite the fact that the development of clever mobile phones and AR technology has made it possible to use simple face identification in mobile AR applications, it still confronts numerous technological obstacles when compared to the PC work platform. Low image quality and graphics processing power, restricted screen size and storage space, and other issues have hampered the technology's popularization and implementation. As a result, smartphone performance will be unable to compete with that of a PC in the near future. Because smartphones lag behind on hardware development, an algorithm operating on a PC cannot effectively transplant, driving a further wedge between mobile and traditional AR technologies in terms of development speed. The limitations of AR technology transplanted to the smartphone platform will, however, become a thing of the past as mobile terminal technology continues to develop and improve. Smartphones will have a higher technical advantage and function as they become more integrated into people's daily lives. In addition, the combination of face detection technology, AR technology and mobile terminals will open a new research direction in the field of AR application.

In 2018, Gaurav Raturi et.al. [2] proposed “Virtual Mirror: The future of Interaction”. In this review, according to Raturi, the user must place the clothing in front of the virtual mirror, which will scan it. The top of the user's body will then be superimposed with the clothing image after collecting the information from the scanned garment. The virtual mirror's reflected picture will then show a virtual appearance of the user wearing the outfit. The garment tracks the wearer's motions using simulated movements that are completely realistic. In addition, the lighting in the fitting room can be changed to improve the user's experience when trying on items. It can also show how the wearing clothing appears at various times of the day. Aside from that, the virtual mirror shows consumers a number of wardrobe possibilities from which they can choose. By using hand motions with Microsoft's motion sensing camera, Kinect 3D, users can select a new size or color option for the clothing. Users can also utilize the virtual mirror to see how the virtual clothing look on their bodies at different times of the day. This can assist consumers become more immersed in the virtual world. The expense of creating a virtual mirror, on the other hand, is considerable due to the high cost of depth sensors like Kinect

3D. It must also be installed on a device with a high performance speed because it uses a lot of processing power. Because the virtual mirror is so enormous, it's only available to in-store customers. In this scenario, internet customers do not have the opportunity to try on clothing. If users wish to try on garments using a virtual mirror, they must go to the store.

"Tendency to Use the Virtual Fitting Room in Generation Y - Results of Qualitative Study," Miroslaw MOROZ et.al. [3] suggested in 2019. This article makes use of a virtual fitting room VIRTUAL FITTING ROOM (VFR), that enables users to try on garments for size, fit, style, and colors on a pc or smartphone screen. The study's main purpose was to figure out the generation Y age group's proclivity to utilize a VFR (i.e. persons born between 1981 to 1999). The second objective was to compare the two types of VFRs that would be used: 2D and 3D. The findings revealed that the research participants had an ambiguous view toward VFR. A 2D VFR built on augmented reality has a greater market, according to the report. VFR effectively serves as a "virtual mirror," allowing consumers to make better informed purchasing decisions. The usage of VFR helps to reduce the amount of returns from customers. On the other hand, "2D overlays" is a rather complex way of service and "sticky" mapping of garments on the customer's form, but "3D mannequin" is a lack of consideration of facial features and current haircut to match the outfit.

In 2020, Rushikesh Kore et.al. [4] proposed “Virtual Clothes Fitting Application Based On Augmented Reality for Online Retailers”. In this paper authors have used marker based AR technology for tracking users motions which is done by holding a marker in one hand, a marker can be a QR Code or link, so the AR marker technology replaces the marker with a garment model and with the help of AR superimposition a 3D model of cloth is superimposed over user’s body. The complete implementation is done on Unity using AR Core’s Motion Tracking and light estimation feature and Vuforia for Android devices. Author have also implemented Garment Modelling using single image, its accuracy depends on the quality of garment image uploaded

In 2013, CEO Yael Vizel et.al. [5], VP of Research and Development Nir Appleboim and CTO Alon Kristal launched Zeekit, with the premise that if online shoppers could see how clothing would look on their own bodies, the technology could reduce the rate of returns due to non-fitting, non-flattering items. Zeekit is a fashion IT start-up which has created the world's 1st virtual fitting room software, which provides a unique and interactive buying experience for each individual. By using their genuine photo and body dimensions, it allows online consumers to view themselves in any piece of clothing available on the internet without having to actually try it on. Zeekit maps a person's image into thousands of segments with real-time image processing and its unique technology, which entails generating 3D maps over 2D photographs. Aside from that, garments are also processed with the same method. The image and clothes of the processed person are then re-mapped into a finished simulation based on their comparable points. The application's biggest flaw, on the other hand, is that the method used is in static mode. The final image of the virtual clothing and human figure is a static image that cannot be viewed from varied perspectives. Users are unable to appreciate the realism because they can only see how well the virtual garment appears on the front of the body. Users may not be attracted in the try-on feature in this scenario because it does not assist users in determining whether or not to purchase the item.

In 2012, C. Garcia Martin et.al. [6] proposed “Human Friendly Interface Design for Virtual Fitting Room Applications on Android Based Mobile Devices”. This article is based on Implementation of a human friendly Virtual fitting room application for android using image processing. For implementation, the author employed a three-stage method that included body detection and size, reference point recognition based on facial recognition and augmented reality indicators, and clothes superimposition over the user's image. Uses Real-time image processing technology to map person &garment using harr-like feature and then garments are superimposed on user’s body simulation using augmented markers, the final simulation shows a person captured in cameras dressed in selected garment. Apart from this user can even select size, color and dress as per their need. Complete project was successfully implemented by author. When used in ecommerce site can increase sale up to 60% and thereby reducing return rate of dresses. It can be easily implemented using a smartphone with good camera, does not require any hardware module or external system. On the contrary Obtaining Accuracy here is a difficult task.

“A study of Camera Application Methods in Unity 3d” by Yang Kuang et.al. [7] This paper looks into the different types of methods unity 3d can be used to present virtual reality world to a user in real time. Unity uses 2 different methods i.e. the perspective camera and the orthogonal camera. The perspective camera captures scenery as we see it, capturing depth and other attributes while an orthogonal camera draws a 2d image of the scene.

“Augmented Reality Application for Preschool children with Unity 3D platform” by Buse Asena et.al. [8] In this article, the authors have made used of the Vuforia Software Development Kit (SDK) which is a software development equipment for mobile devices. It is used to create AR based applications and helps in adding advanced computer vision, which makes it easier for the device to recognize and name objects in the real world. The authors added different kinds of animations of the animals, children draw to the database of the app. When a particular animal is scanned, the SDK captures the image and recognizes the animal with a pixel transformation procedure while matching it with the database, once the picture is recognized the respective animations are displayed in an AR view.

III. Proposed System

The goal of this project is to create an AR virtual fitting room software for smartphones utilizing augmented reality and computer vision technology. The suggested application is mostly based on the IOS mobile platform. The essential prerequisite for detecting, detecting, and tracking human body movements in order to engage with proposed software contents such as virtual garment in real-time is a smartphone camera.

The application's Graphical user interface (GUI) is meant to be basic and easy to use so that it may be used by individuals of all ages. The required and primary user interfaces in this app are the clothing catalogue, garment details, and camera preview. To meet the usability criteria, user interfaces must be developed and built using heuristic concepts that are simple to learn, efficient, easy to recall, error-free, and enjoyable.

In addition, the AR core foundation's human body recognition and motion tracking model is used to recognise & identify the human body skeletal joint positions in real-time. To obtain a classification result, the live video is fed into the model. The available clothing is also converted into models in order to adapt them to the human body in real time using

body skeleton-based joints and garment dimensions. In a nutshell, an augmented reality virtual fitting room mobile app for iOS is being developed in conjunction with a human body recognition and motion tracking model.

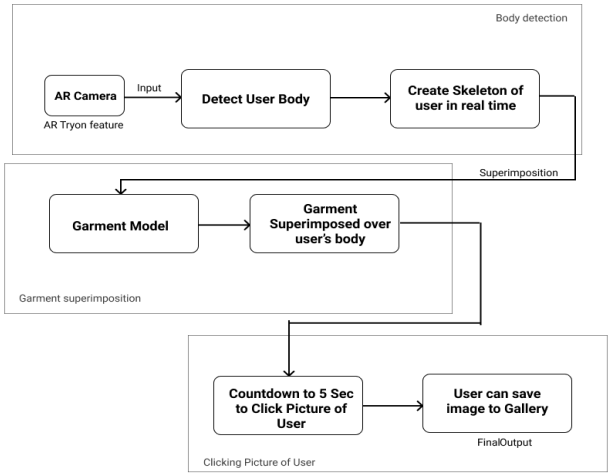

Figure 3.1: Block Diagram of the system

IV. Implementation

The iPhone camera is being used to identify and scan the user's body in order to gather information on the user's skeletal joint positions and body measurements. This is done using unity 3D's Human Body Tracking library in which AR kit recognizes and tracks a person's movements using an iOS device's rear camera. Human Body Tracking 3D sample of AR Kit demonstrates 3D world space body tracking. A 3D skeleton is generated when a person is detected. This sample requires a device with an A12 bionic chip running iOS 13.

Rigging a Model for Motion Capture:

AR kit recognizes and tracks a person's movements using an iOS device's rear camera. Reality-Kit applies the detected motion to a 3D character model in real time, allowing the person on camera to control the movement of the 3D model, much like a virtual puppet.

This AR Anchor subclass tracks the movement of a single person. You enable body tracking by running your session using AR-Body Tracking Configuration. When AR kit recognizes a person in the back camera feed, it calls your delegate's function with AR Body Anchor. A body anchor's transform position defines the world position of the body's hip joint.

In your 3D-modeling software package (such as Maya, Cinema4D, or Modo), import the provided skeleton and the custom mesh model that you want to use with AR kit's Motion Capture functionality. You should model your mesh in a standard T-pose. very important that you configure your import settings so that they don't change the orientation of the imported character or any of the skeleton's individual joints. After import, the character should be oriented facing the +Z axis, with the top of its head oriented toward the +Y axis, and the character's left hand pointing along the +X axis. Your scene should also be configured with +Y as the up axis. In some software packages, this orientation requires changing the default scene configuration

Next, align your mesh to the imported skeleton, then scale, translate, and rotate it until it matches the imported skeleton as closely as you can get it. Finally, freeze transformations on the mesh. Finish matching the mesh and armature by moving any joints of the armature that don't line up correctly with the mesh, making sure that the X axis still points down the length of the bone after you're done moving it. Many 3D software packages include tools to automatically re-orient joints based on the location of their children. If a re-orienting feature is available in your software package, use it when you're done moving joints into new locations.

Once you've aligned your mesh with the skeleton, bind your mesh to it. For best performance, you should use no more than four skin influences per vertex. You character should be modeled in a T-pose, your scene should contain only one bind pose, and the rotational values of each joint in your hierarchy should match the values in the provided example skeleton.

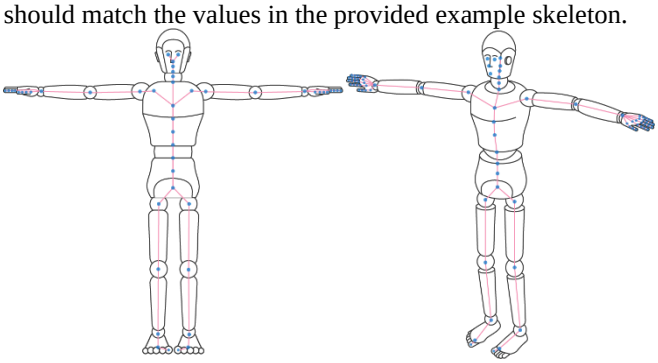

Figure 4.1: Character Model

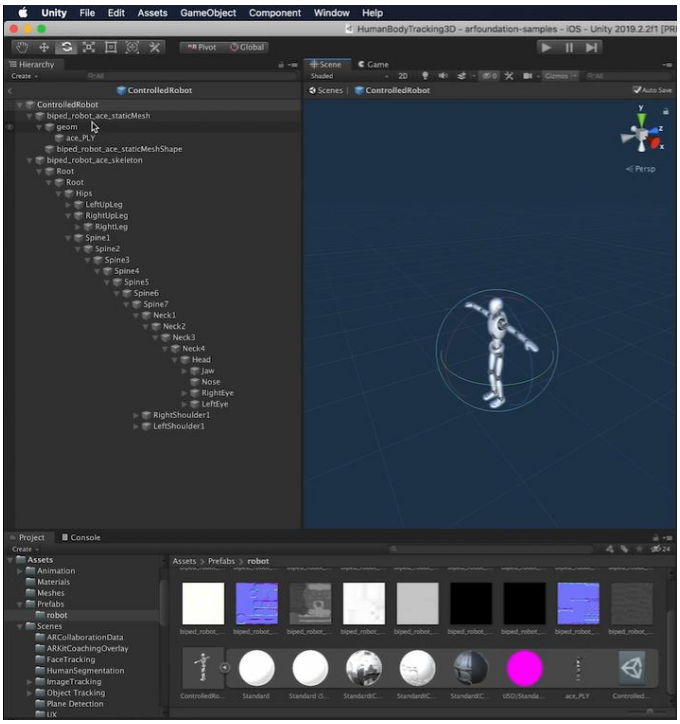

Figure 4.2: AR (augmented reality) kit layout

AR kit's body-tracking functionality requires models to be in a specific format. Models that don't match the expected format may work incorrectly, or not work at all. We need to verify that your character's scene coordinate system and orientation match AR kit's expectations, and ensure that your skeleton matches ARkit's expected joint names and hierarchy for Motion Capture.

The joints that make up your models skeleton must exactly match AR kit's required joint names. Additionally, the relationship between joints must also match AR kit's layout.

Although your skeleton must contain all the expected joints in the correct hierarchy, you don't have to bind vertices to every bone. If your character doesn't need moving eyes, for example, its skeleton must still have the bones that control the eyes, but you can simply bind no part of your model to those bones so they have no affect on your model.

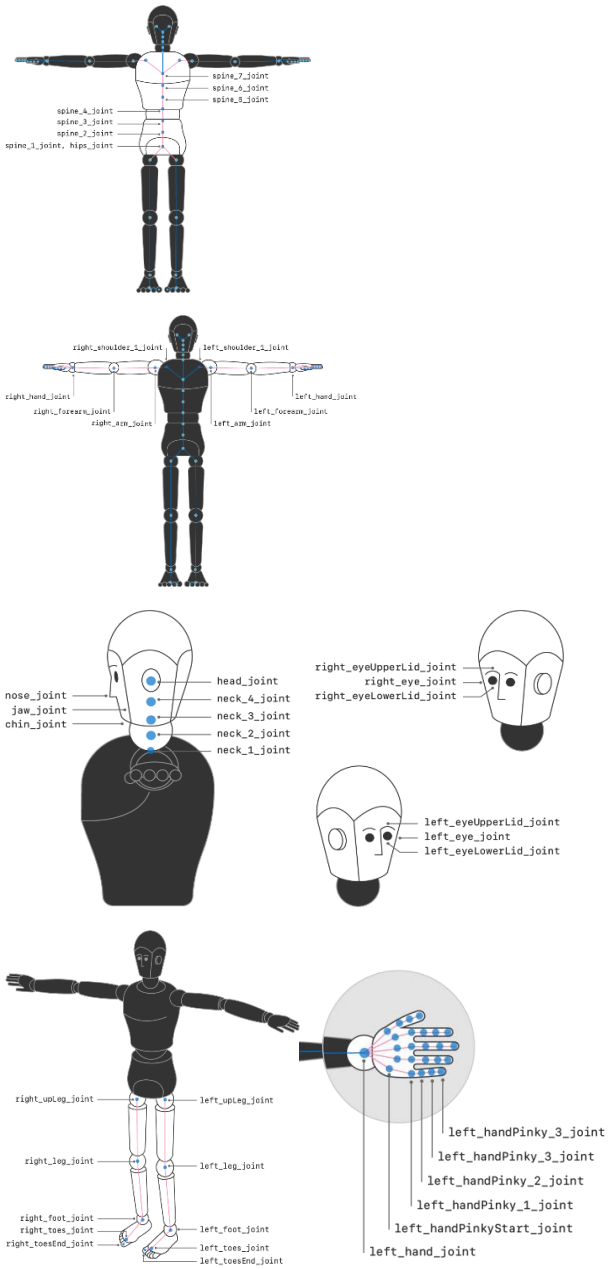

Figure 4.3: Joints Detection

After validating our model for motion capture we obtained the following output in which body was tracked successfully and a 3D skeleton was generated which imitates human motion in real time.

Figure 4.4: Body tracking using 3D skeleton

The virtual clothing is then placed on the user's body using data from the user's body measurements, skeleton joint positions, and garment measurements.

To superimpose the clothing over the user's body, we needed a 3D model of the garment, which we created using Blender. We used a bone armature to connect our dress model to a 3D dress model, where the bone armature is controlled by Ar and the dress is controlled by the bone armature.

Figure 4.5: 3D Garment model

Figure 4.6: Garment Mesh

For enhanced realism, the virtual apparel can be seamlessly customized to the user's body. Through the smartphone camera, the virtual garment monitors the tracked user's body motions with realistic virtual movements to confirm that the virtual clothing is fitted to the user's body. The virtual clothing will continue to display as in real-world view based on the body movements.

We used figma application to create the User Interface and prototype of our application idea. Few UI screens are demonstrated below.

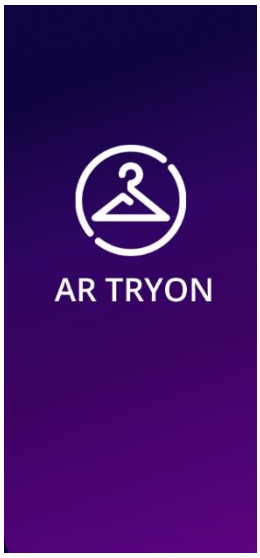

Figure 4.7: Splash Screen

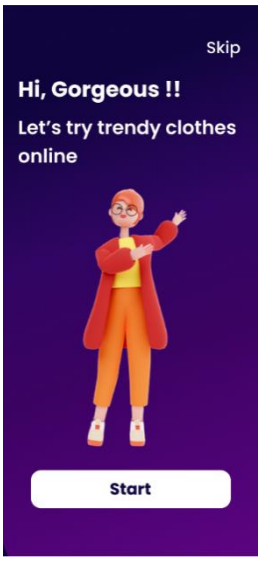

Figure 4.8: Welcome Screen

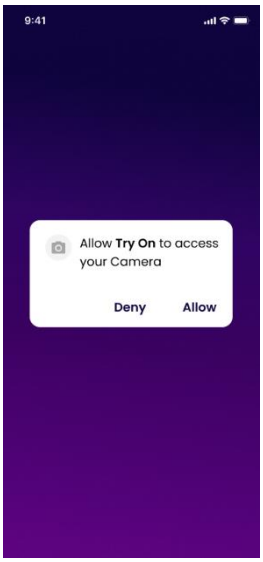

Figure 4.13: Permission

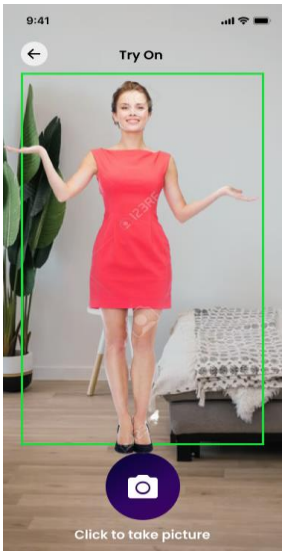

Figure 4.14: Body Detection

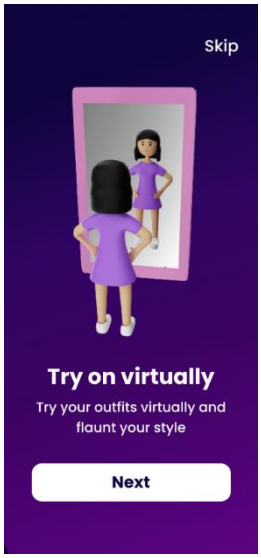

Figure 4.9: Tutorial Screen

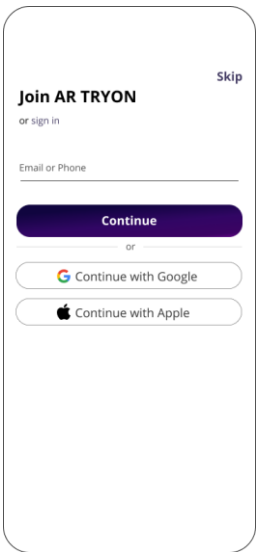

Figure 4.10: Login Screen

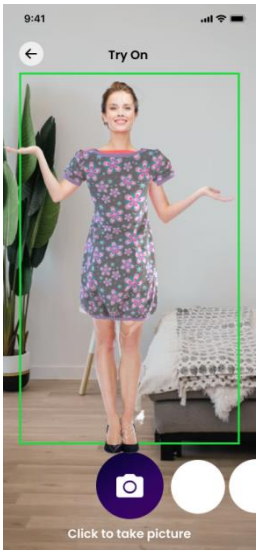

Figure 4.15: Final Result

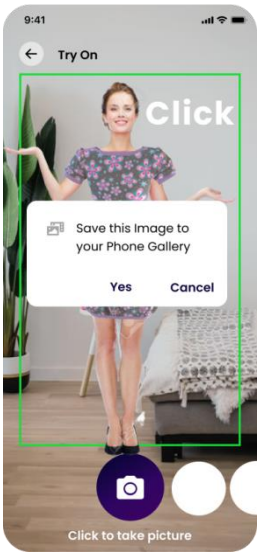

Figure 4.16: Captured Image

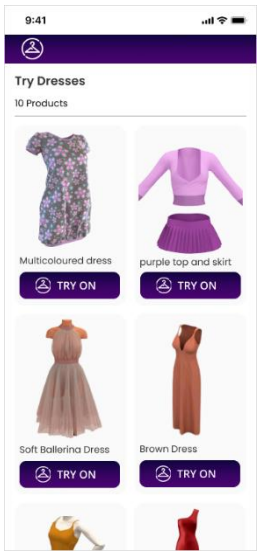

Figure 4.11: Shopping Menu

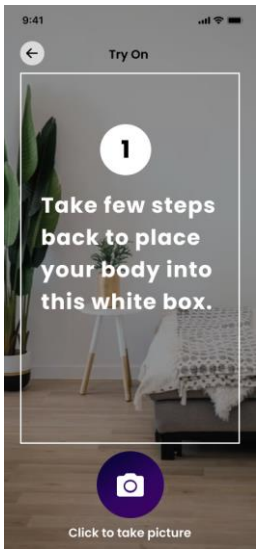

Figure 4.12: Try on Interface

V. Conclusion and Future Work

In this paper we described an Augmented Reality Try on system for clothing using AR foundation and Unity 3D. We used AR kit to track users body in real time using rear camera and superimposed a 3D garment over user's body in real time allowing user to move freely and turn to take a look at clothe fit and color and click a picture.

In near future we can implement below features to enhance user experience of this project.

- Recommendation System-Provides recommendations of clothing according to user's purchase history or wish history.
- Implementation in Android Devices
- Motion Capture System- Use hand motions to interact with the application content.
- Implementing Virtual Mirror- Implementing Virtual fitting room app on a mirror screen which can be effectively useful in shopping malls and stores.

The concept of e-commerce itself is an exciting way of shopping but, it can be made more exciting if we can see how a particular clothe would look on us. AR is the future of

visualization and with the help of this technology used in our AR-Tryon application the whole shopping experience will become magnificent.

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