21ST CENTURY TRENDS OF AR- FOBOM

An Multimedia Project submitted in partial fulfillment of Requirements for the Degree of Bachelor of Technology (DTDP)

By

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B.Tech (Digital Techniques for Design and Planning) – VIII Semester

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July 2022

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DEPARTMENT OF DIGITAL TECHNOLOGY

CERTIFICATE

I/We Certify that the Information Technology Project entitled **"21st CENTURY TRENDS OF AR -FOBOM "** submitted by **Ms. K.Durga Pravallika** bearing Roll No. **18011BC028** on this 27h of JUNE, 2022 in partial fulfillment of the Requirements for the Degree of **BACHELOR OF TECHNOLOGY (DIGITAL TECHNIQUES FOR DESIGN AND PLANNING)** of University is a bonafide work to the best of my/our knowledge and may be placed before the Examination Board for their consideration.

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GUIDE CERTIFICATE

This is to certify that it is a bonafide record of the Dissertation work entitled **" 21st CENTURY TRENDS OF AR -FOBOM "** done by **Ms. K. DURGA PRAVALLIKA** a student of **B.Tech (DTDP)** in the **Department of Digital Technology**, JNAFAU school of Planning and Architecture, Mahaveer Marg, Masab Tank, Hyderabad – 500028. During the period 2018-2022 in partial fulfillment of the requirements for the degree of B.Tech in Digital Techniques for Design and Planning. This work is not submitted to any University for the award of any Degree/ Diploma. This work is carried out in JNAFAU School of Planning and Architecture, Mahaveer Marg, Masab Tank, Hyderabad – 500028.

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ACKNOWLEDGEMENT

At every outset I express my gratitude to almighty lord for showering his grace and blessings upon me to complete this project. Although our name appears on the cover of this book, may people had contributed in some form or the other form to this project development.

I render my solicit thanks to Head of the Department of Digital Technology, **Er. S.Ravi Kiran** for his encouragement through the academics.

I render my solicit thanks to project guide **Er. Prithvi Raj Baddula** who were showering lot of interest guiding us in developing our project successfully.

I express my gratitude to **Dr.S.Kumar,** Principal of **JNAFAU School of Planning And Architecture** for his valuable suggestions and advices throughout the **Digital Techniques for Design and Planning** course. I also extend my thanks to other faculties for their cooperation during my course.

Yours Sincerely

K.Durga Pravallika

ABSTRACT

Augmented reality it came a long way now every user has access to this computer vision-based recognition algorithms to augment sound, video, graphics, and other sensor-based inputs o real world objects using the camera of your device.

The well-known AR Face filters, AR Portal, Design, Body tracking AR Games, Medical we are using today has a lot of potential, but the ease of usage how a user has to use these is not well defined. The goal of this project is to research possibilities to further extend these to every user how it navigates them into their real life.

The goal of this project is divided into 3 parts, first- How AR Technology works, How Agile model is used for this project. second-development framework right from UI Elements to Coding. third-Testing and Validation for user end research of further possibilities of project.

To attain this , we will be using Augmented Reality technology and building these effects which we use face filters, outliner effect, AR portal, Body tracking games, Medial purposes. By using the “Spark AR Hub” software, can achieve these filters and publish them into Instagram platform. For medical application “Unity 3D Game Engine” will be using.

Keywords: Body Tracking, Framework, UI Elements, Testing, Validation.

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Chapter 1

Introduction

1.1 Overview

Augmented Reality and its trends in 21st century

Augmented Reality (AR) is an innovation that 'expands' your existence by mixing the genuine and computerized world in such a manner to give an extraordinary encounter.

We are utilizing Augmented Reality consistently, albeit a great many people don't know about it. Models date from the old films like ***Who framed Roger Rabbitor Space Jam*** to the current days when Augmented Reality took off in versatile with well-known applications like Pokemon Go or includes on Snapchat that acquainted many individuals with the apparently cutting-edge idea.

The AR market is developing dramatically. By 2030, specialists gauge the business in general will be worth more than $76 billion, a monstrous development from $26.75 billion out of 2021. It will be intriguing to see what developments crop up during that time and how much simpler expanded reality can make our lives.

For instance, consider Snapchat and their filters, where you can make entertaining selfies with different extra's and channels and so on.

Instead of Virtual Reality (VR) which really 'retains' you into a 3D climate or circumstance, AR places computerized data onto the genuine picture or video subsequently saving a large portion of the climate unaltered.

AR has become inescapable because of a basic reality that you can encounter AR utilizing just a cell phone while for VR you want to have exceptional hardware.

Many individuals consider AR a device for the sake of entertainment, however it

is a fairly strong extra to any industry these days as it can help commitment and make reasonable encounters with different items.

1.2 Objectives

Many individuals consider AR a device for the sake of entertainment, however it is a fairly strong extra to any industry these days as it can help commitment and make reasonable encounters with different items.

Fig 1.1 *Augmented Reality in Education*

- **FACE FILTERS :** There are over 1billion overall clients on Instagram which makes it the greatest stage for marked Augmented Reality AR Filters. It's a gigantic measure of eyeballs searching for connection with content. What's more, research shows that individuals who use AR Filters use them on normal for 75 seconds - 4X longer than portable video.
- **WORKOUT INDUSTRY :** Organizations like PhotonLens are making AR headsets for the vast majority wellness applications, like boxing, ping pong, and yoga. These applications add to a customary games movement in various ways: cooperation with superstar mentors, safe drenching in dynamic gaming conditions, and in particular, gamification of one's wellness schedule. At PhotonLens, they treat gamification pretty seriously; their organizers are previous versatile gaming organization pioneers.
- **GAMING** : Augmented reality gaming (AR gaming) is the reconciliation of game visual and sound substance with the client's current circumstance continuously. Dissimilar to computer generated reality gaming, which frequently requires a

different room or restricted region to establish a vivid climate, augmented reality gaming utilizes the current climate and makes a battleground inside it.

- **MEDICAL:** AR coordinates computerized data with the client's current circumstance progressively and is turning out to be more available and reasonable for clinical schooling and imaging, dentistry, and attendant preparation. AccuVein, VIPAR, ARnatomy, and VA-ST are among the accessible AR answers for medical care.
- **DESIGN :** Creating applications that empower organizations to superimpose 3D models into actual spaces will permit them to convey more grounded deals and showcasing material. Specialists and CAD (PC helped plan) modelers will likewise profit from AR, as it gives them the resources to deliver items and different resources in a 3D space for a more straightforward work process and show.

1.2 Previous Studies

The meaning of AR isn't confined to specific showcase innovations, for example, a Head-Mounted Show (HMD). Nor is it restricted to the visual sense. AR might possibly apply to all detects, including contact, hearing, and so on. Certain AR applications additionally require eliminating genuine items from the climate, what's more to adding virtual articles. For instance, an AR perception of a structure that used to remain at a certain area would initially need to eliminate the ongoing structure that exists there today. A few specialists call the errand of eliminating genuine items Mediated or Diminished Reality, however, this overview thinks of it as a subset of Augmented Reality.

1.3 Goal of this Project

This project consists of how the applications of AR that are highlighted in the 21st century. These will be the core applications that may rule over the next few decades. For fantasy films one can imagine themselves they wish they could be in that character or whether for its movie promotion, Based on this there will be AR Filters that everyone can accessible and in case of design and creative space also the designers will be having a ease of access to the 3D models and showcase their creativity.In fitness industry , there’s the gamification and AR will be confined together and they track the human body

movements and fits the exercises based on that.In Medical ,the AR will be having an imprints of human organs 3d models or incase of surgery trainiings. Same Incase of Real Estate and Customer Experience , when there's open space and has to build their house,they can mockup or view the product in that space with the help of 3D Model and AR business cases .

1.4 SPARK AR & UNITY

1.4.1 SPARK AR

Spark AR is a studio device from Facebook that permits clients to make their own AR impacts for portable use. First sent off in 2017, Facebook keeps on adding abilities to the stage - most as of late, adding in examinations for Instagram and Facebook crusades. Viable for Mac and Windows, the AR stage is similar to devices like Sketch or Photoshop - just this is for expanded reality.Spark AR empowers to make their own AR impacts for portable utilizing a set-up of instruments - from fixing to liveliness. Likewise, one doesn't need to be a specialized virtuoso to have the option to utilize it. It permits them to:

1. Make your own AR impacts, regardless of a specialized foundation
2. Import your own 3D documents and sounds
3. Work regardless of code

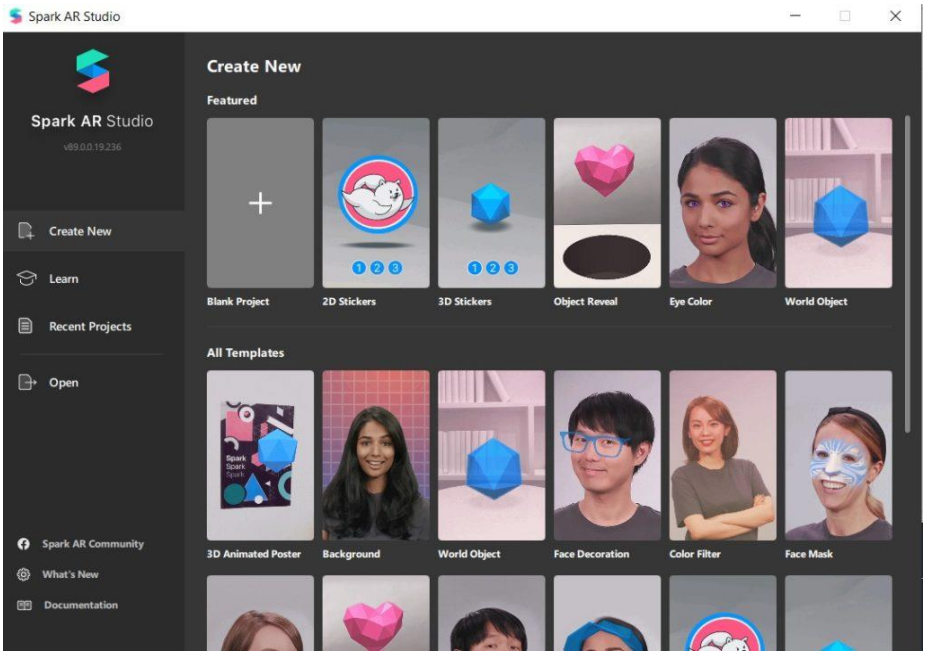

Fig 1.2 *Spark AR Interface*

1.4.2 UNITY

Unity is a cross-stage game motor created by Unity Technologies, first reported and delivered in June 2005 at Apple Worldwide Developers Conference as a Mac OS X game motor. The motor has since been step by step reached out to help an assortment of work areas, portable, console and computer-generated reality stages.

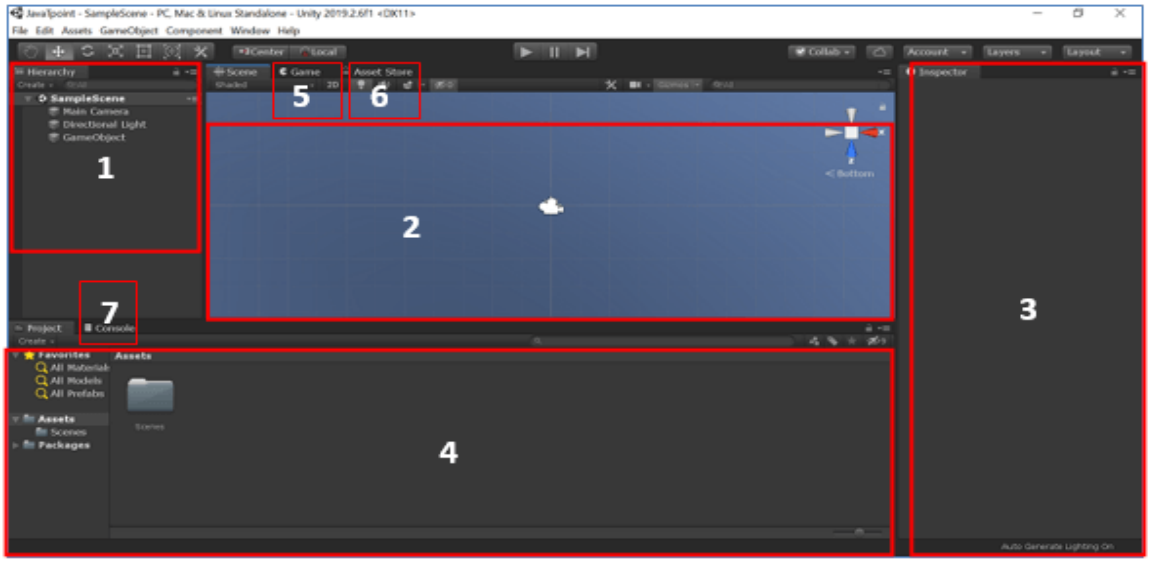

Fig 1.3 *Unity Interface*

1. Hierarchy Window
2. Scene View
3. Inspector Window
4. Project Window
5. Game Window
6. Asset Store
7. Console Window

2.Literature Review

Many individuals consider AR a device for the sake of entertainment, however it is a fairly strong extra to any industry these days as it can help commitment and make reasonable encounters with different items.

2.1 VIRTUAL REALITY

Virtual Reality (VR) is characterized in Oxford Dictionary as a PC created recreation of a 3D-climate that can be cooperated with an individual utilizing exceptional gear (Oxford Dictionary 2018.). The unique hardware referenced in the definition are a dream covering protective cap with a screen inside and sensors or regulators connected to hands. Unadulterated computer generated simulation would catch every one of the feelings of an individual. Cell phone use in VR requires a headset and at times a regulator where the telephone goes about as the screen for the VR experience, in any case, at present just specific telephone models can run VR programming without a hitch (Google 2019). Instances of VR programming are Gear VR and Daydream, created by Samsung and Google, separately.

2.2 AUGMENTED REALITY

Augmented Reality (AR) begins from computer generated reality. In 1968, Ivan Sutherland made the initial transparent head-mounted show that used cathode beam cylinders to produce straightforward noticeable lines (Sutherland 1968, 759.). In any case, the expression "expanded reality" started in 1992 from crafted by Caudell and Mizell (Arth and al. 2015, 3.).

The contrast between AR and VR is that VR is knowledgeable about a virtual world and AR is overlaying virtual items into the world through a camera. Increased reality additionally has sub-classifications based on what kind of innovation is utilized to expand the climate. They make sense momentarily underneath.

2.2.1 MARKER BASED AR

Marker based AR utilizes PC vision to perceive a specific example in a 2D picture or 3D item. These unmistakable pictures or items are called markers. AR programming permits designers to situate a picture or 3D item corresponding to the marker.

In figure 1, we see an example of Vuforia Engine's image target recognition. The engine tracks and compares features found in the image to a known database of targets. As long as the image is in view of the camera, the object will continue to be augmented in relation to it (PTC Inc. 2018a). An example of this can be found in Figure 2.

Fig 2.1 *Vuforia Engine Image Tracking and 3D Model Augmentation*

2.2.2 MARKER-LESS AR

Markerless AR is additionally alluded to as area based AR. Rather than markers to situate an article for the client, it uses the gadget's direction and GPS-directions to populate the screen. One more method for making a markerless AR experience is through Bluetooth guides to work out the place of the gadget. An illustration of an area based game is Pokémon Go displayed in Figures 3.1 and 3.2.

In Pokémon Go, the player walks around in real life and their position is updated on the map as shown in Figure 3.2. When they encounter a Pokémon in their vicinity, the player can click on them to move to the AR view as shown in Figure 3.1 where they view the world through their phone's camera and try to swipe the ball in the monster's direction to catch it.

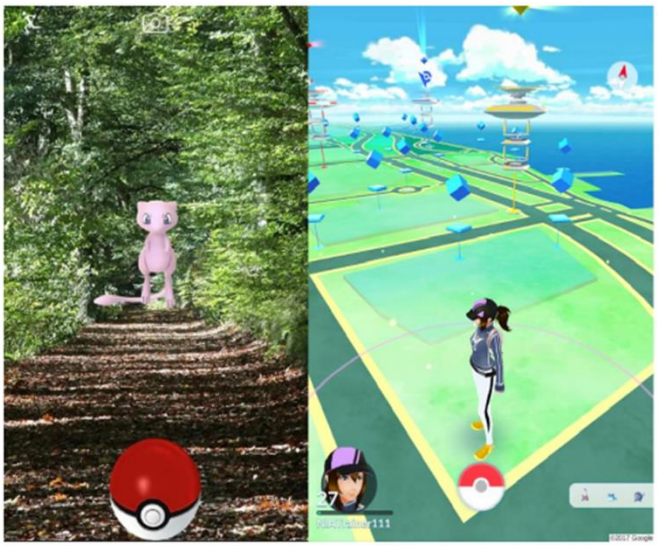

Fig 2.2 *Screenshots of Pokemon-go Gameply from Google play store*

2.2.3 SUPER IMPOSITION AR

Superimposition AR is like marker-based AR. For instance, this can be utilized to review furniture inside one's home as displayed in Figure 5.

Ikea's Place superimposes an AR object, for this situation furniture, to a space for the client to examine. The application utilizes PC vision examination to filter the profundity of the room, so the application can scale protests consistent with scale.

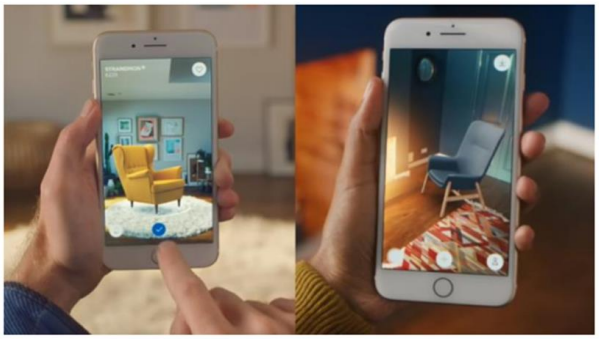

Fig 2.3 *Demonstration of IKEA Furniture in Augmented*

2.2.4 MOBILE AUGMENTED REALITY(MAR)

Mobile Augmented Reality (MAR) can be any of the kinds of AR, marker-based, markerless, projection-based or superimposition. The term versatile alludes to having the option to take a gadget on an individual. Then again, a differentiation can be made by ordering a gadget as convenient, on the off chance that something can be moved from point A to point B, and versatile, on the off chance that a gadget can be carried on individually effortlessly. For instance, a PC or even PC can be moved, notwithstanding, activity of the gadget while moving is troublesome and confined.

Fig 2.4 *Mobile Augmented Reality (MAR) Furniture Interface*

2.3 HISTORY OF AUGMENTED REALITY

The innovation has made considerable progress with a developing rundown of purpose cases for AR. From NASA simulations vivid showcasing encounters, increased reality makes errands simpler.

2.3.1 AR in the 60’s & 70’s

1968: Ivan Sutherland, a Harvard teacher and PC researcher, made the principal head-mounted show called 'The Sword of Damocles'.

1974: Myron Kruger, a computer researcher and artist, built a laboratory at the University of Connecticut called ‘Videoplace’ that was entirely dedicated to artificial reality.

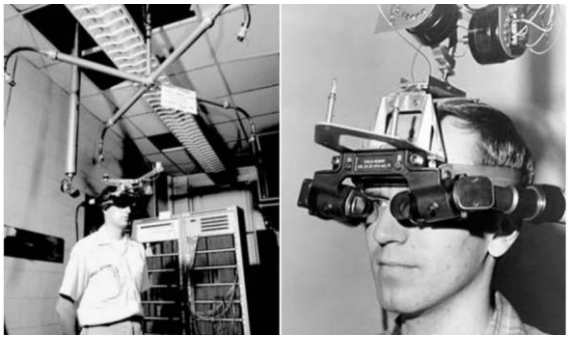

Fig 2.5 *AR in 60's & 70's*

2.3.2 AR in the 80's & 90's

1990: Tom Caudell, a Boeing researcher, coined the term 'augmented reality'.

1992: Louis Rosenburg, a researcher in the USAF Armstrong's Research Lab, created 'Virtual Fixtures', which was one of the first fully functional augmented reality systems.

1994: Julie Martin, a writer and producer, brought augmented reality to the entertainment industry for the first time with the theater production titled Dancing in Cyberspace.

1998: Sportsvision broadcasts the first live NFL game with the virtual 1st & Ten graphic system – aka the yellow yard marker. The technology displays a yellow line overlayed on top of the feed so that viewers can quickly see where the team just advanced to get a first down.

1999: NASA created a hybrid synthetic vision system of their X-38 spacecraft. The system leveraged AR technology to assist in providing better navigation during their test flights.

Fig 2.6 *AR in 80's & 90's*

Fig 2.7 *NASA using AR*

2.3.3 AR in the 2000's and TODAY

2000: Hirokazu Kato developed an open-source software library called the ARToolKit. This package helps other developers build augmented reality software programs. The library uses video tracking to overlay virtual graphics on top of the real world.

2003: Sportvision enhanced the 1st & Ten graphic to include the feature on the new Skycam system – providing viewers with an aerial shot of the field with graphics overlaid on top of it.

2009: Esquire Magazine used augmented reality in print media for the first time in an attempt to make the pages come alive.

2013: Volkswagen debuted the MARTA app (Mobile Augmented Reality Technical Assistance) which primarily gave technicians step-by-step repair instructions within the service manual.

2014: Google unveiled its Google Glass devices, a pair of augmented reality glasses that users could wear for immersive experiences.

2016: Microsoft starts shipping its version of wearable AR technology called the HoloLens, which is more advanced than the Google Glass, but came with a hefty price tag. It's definitely not an everyday type of accessory.

2017: IKEA released its augmented reality app called IKEA Place that changed the retail industry forever.

Fig 2.8 *Google glasses*

Fig 2.9 *IKEA Furniture*

2.4 WORKING OF AR

- First is the generation of images of real-world environments. . Second is utilizing innovation that permits the overlaying of 3D pictures over the pictures of this present reality object. The third is the utilization of innovation to permit clients to associate and draw in with the reproduced conditions.
- AR can be shown on screens, glasses, handheld gadgets, cell phones, and head-mounted displays.
- In that capacity, we have versatile based AR, head-mounted gear AR, savvy glasses AR, and electronic AR. Headsets are more vivid than portable based and different sorts. Smart glasses are wearable AR gadgets that give first-individual perspectives, while electronics don't need downloading of any application.

2.5 S.L.A.M TECHNOLOGY BEHIND AR

Simultaneous Localization and Mapping (SLAM) technology is a set of algorithms that solve simultaneous localization and mapping problems. S.L.A.M. technology (Simultaneous Localization And Mapping), and Depth Tracking technology for calculating the distance to the object using sensor data, in addition to other technologies.

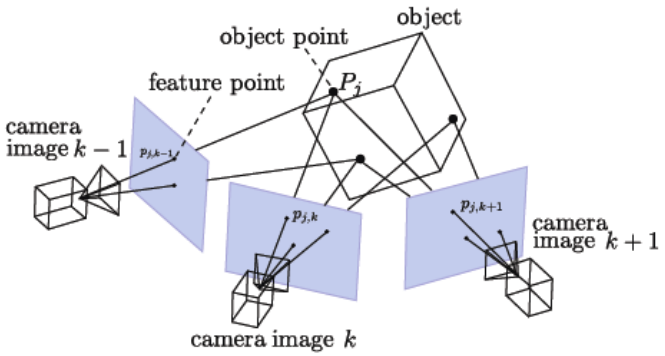

Fig 2.9.1 *S.L.A.M Technology*

- SLAM uses feature points to help users to understand the physical world. The technology allows apps to understand 3D objects and scenes. It allows tracking of the physical world instantly. It also allows the overlaying of digital simulations.
- SLAM uses a mobile robot such as mobile device technology to detect the surrounding environment then create a virtual map; and trace its position, direction, and path on that map. Aside from AR, it is employed on drones, aerial vehicles, unmanned vehicles, and robot cleaners, for instance**,** it uses ***artificial intelligence and machine learning*** to understand locations.
- Feature detection and matchings are done using cameras and sensors that collect feature points from various viewpoints. The triangulation technique then infers the three-dimension location of the object.

2.6 LIMITATIONS OF PROJECT

The project is solely restricted to Augmented Reality, and its trends that will rule over the 21st century. The Mobile based Augmented Reality Experience can be accessed by anyone, and to make it more easy to access ,the platform Instagram is selected. It consists of diverse libraries that support the AR experiences perfectly irrespective of specifications of mobile. Instead of that everyone has an ease of access to instagram these days.Instead of generating multiple Android Programming Kit's(APK) for various AR applications , directly publishing them into Instagram will have an effective output.

2.7 REQUIREMENT SPECIFICATION

2.7.1 SOFTWARE REQUIREMENTS

Language : C# , Java Script

Operating system : Android 8.0 or more Tools

- Spark AR
- Unity 3D
- Autodesk Maya
- Vuforia
- Substance Painter

2.7.2 HARDWARE REQUIREMENTS

- RAM Capacity : 4GB
- Memory : 120 MB
- Graphics Card : 1 GB
- Accessories : Smart phone with AR support

2.7.3 SOFTWARE SPECIFICATIONS

2.7.3.1 SPARK AR

Spark AR is the AR filters creation platform developed by Facebook and they will publish on Instagram

After installation of Spark AR Studio, you need to log in with Facebook credentials to enter the development environment.

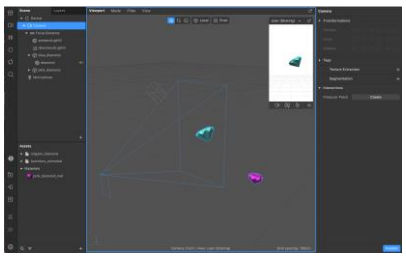

Fig 2.9.2 **Spark AR Interface**

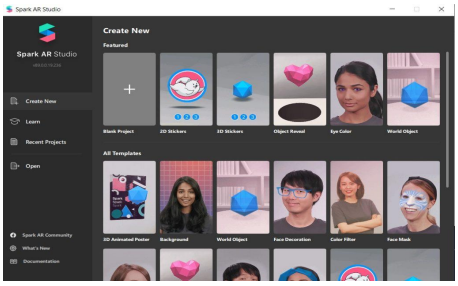

Fig 2.9.3 **Spark AR Portal**

The Viewport

- This is the middle section of the Spark AR Studio interface. You can see and work with the effect you're building here.
- When the Camera is selected in the menu on the left of the screen, blue lines will appear in the Viewport. These lines show where the camera is pointing and which objects are in view of the camera.
- In the image above, the pink diamond is a child of the Camera in the Scene panel. It won't be visible on the screen of the device, because its position is outside the blue lines of the camera.
- At the top of the Viewport are the ***Manipulators***. Use them to quickly change your object's:
    a. Position - to choose where your object is placed within your scene.
    b. Scale - to make your object appear bigger or smaller.
    c. Rotation - to rotate your object.

Editing objects in the Viewport

3D and 2D objects can be edited in the Viewport. You can change their position, scale and rotation. The default setting is for editing 3D objects. To switch to 2D, at the top of the interface, to the right of Viewport, click the Mode menu.

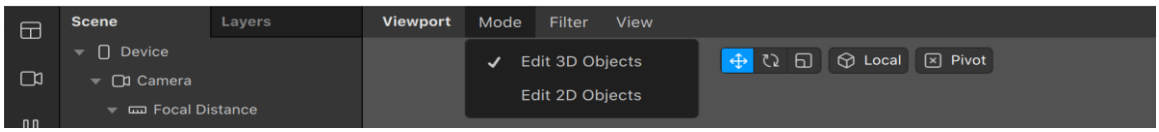

Fig 2.9.4 *Spark AR Mode View*

When this option is:

- Set to 3D, you can edit 3D objects.
- Set to 2D, you can edit 2D objects.

The Simulator

The Simulator represents a device screen. For example, a mobile or a tablet.

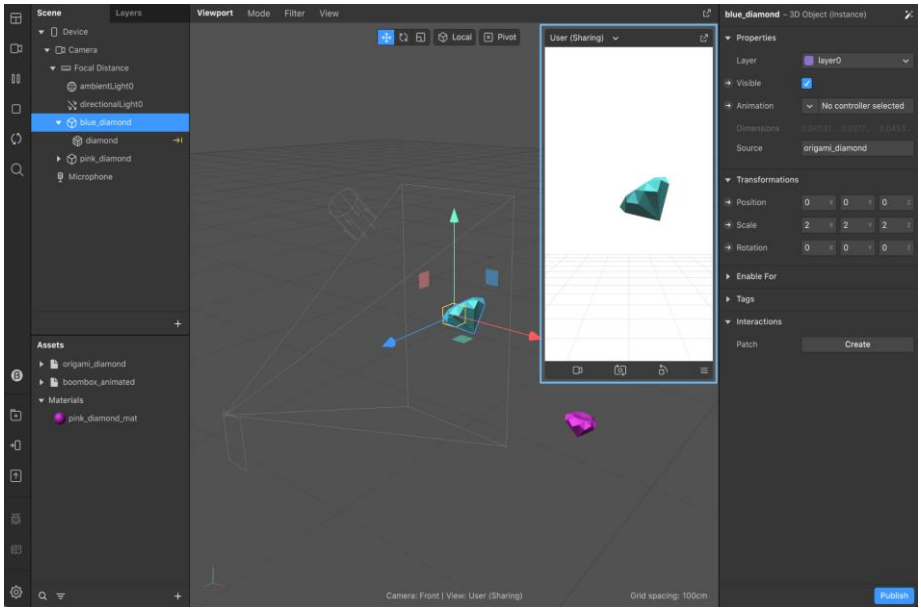

Fig 2.9.5 *Spark AR User Panel*

The Scene panel

Adding objects to the Scene panel on the left of the interface will add them to your effect.

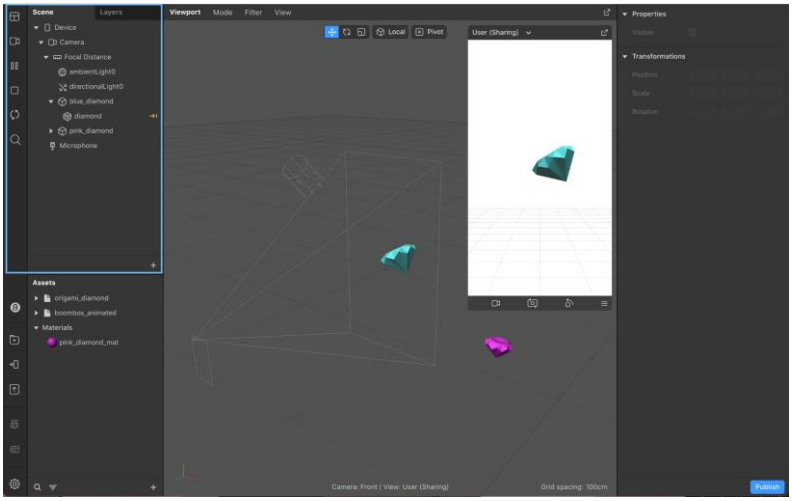

Fig 2.9.6 *Spark AR Scene Panel*

The Assets panel

Click + to create assets or add your own. Right clicking or double clicking and empty space in the panel will also work. You can add textures, materials, 3D models, animations and audio files here.

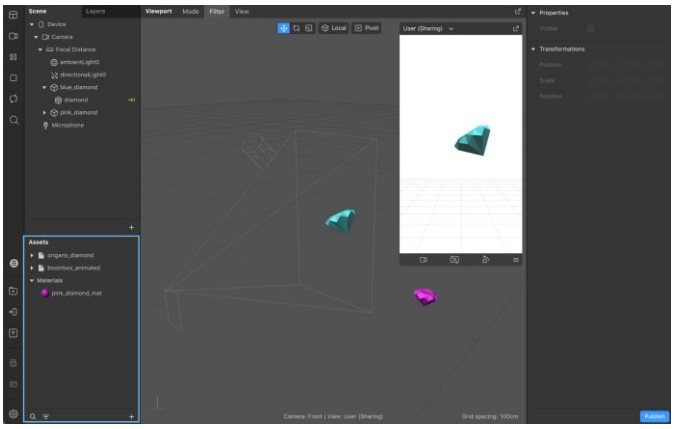

Fig 2.9.7 *Spark AR Asset Panel*

The Inspector

Use the Inspector to make all kinds of changes to assets and objects. You'll need to select the asset or object in the Scene panel or Assets panel first.

Below, we've selected one of the mesh that makes up the 3D object in our scene.

We could use the Inspector to change:

- Which layer it's on, by adjusting the dropdown next to Layer.
- Whether or not it's visible in the scene, by checking the box next to Visible.
- Its position, scale and rotation, by changing the X, Y and Z values under Transformations.
- Its material, by clicking the dropdown under Material.

We could also click Create, next to Patch. This will create a patch representing the mesh in the Patch Editor.

Some properties have arrows to the left of them. This means a patch can be created to represent the property.

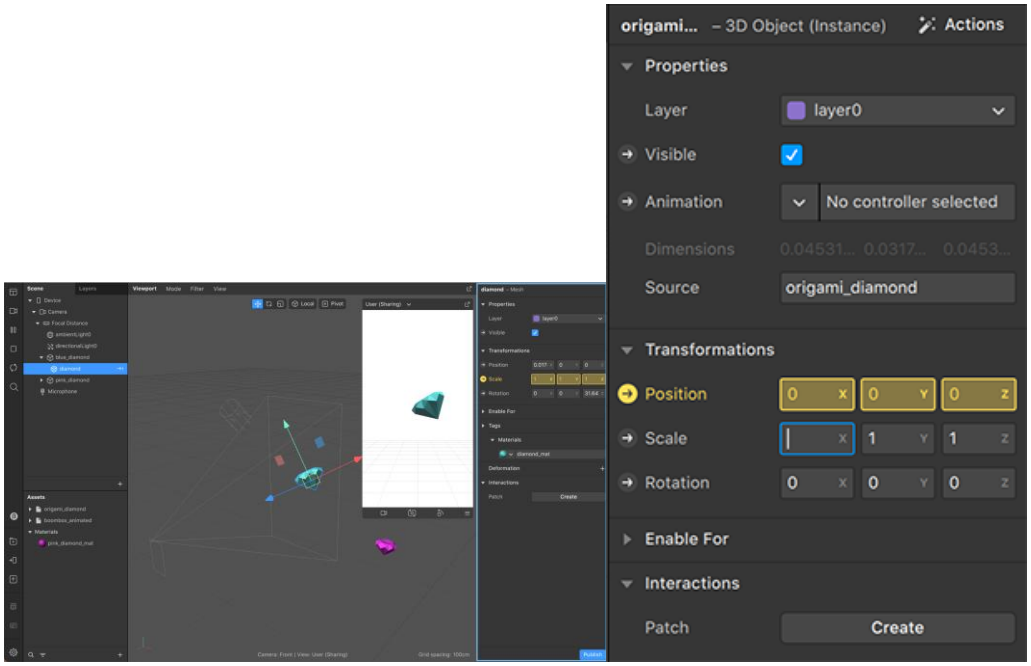

Fig 2.9.8 *Spark AR Scene Properties Panel*

The Patch Editor and Console

Use the Patch Editor to create effects with logic, animation and interactivity, without using scripting. Use the Console to add JavaScript to your project.

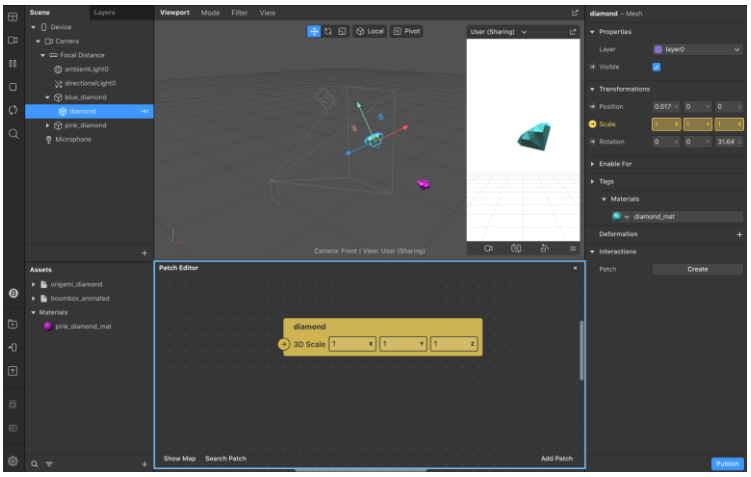

Fig 2.9.9 *Spark AR Scene Patch Editor*

To open or close the Patch Editor or console, click View in the menu bar and select either:

- Show/Hide Patch Editor.
- Show/Hide Console.

Both the Patch Editor and Console will open at the bottom of the screen.

2.7.3.2 UNITY

Unity is a cross-platform game engine developed by Unity Technologies, first announced and released in June 2005 at Apple Worldwide Developers Conference as a Mac OS X game engine. The engine has since been gradually extended to support a variety of desktop, mobile, console and virtual reality platforms. It is particularly popular for iOS and Android mobile game development and is considered easy to use for beginner developers and is popular for indie game development.

The engine can be used to create three-dimensional (3D) and two-dimensional (2D) games, as well as interactive simulations and other experiences. The engine has been adopted by industries outside video gaming, such as film, automotive, architecture, engineering, construction, and the United States Armed Forces.

Fig 2.9.9.1 *Unity Window Interface*

(A) The toolbar provides access to your Unity Account, Unity Cloud Services, and Unity Collaborate, the play, pause and step controls, and Unity Search, a layer visibility menu, and the Editor layout menu (which provides some alternate layouts for the Editor windows, and allows you to save your own custom layouts).

(B) The Hierarchy window is a hierarchical text representation of every **GameObject.**In the **Scene,**Each item in the Scene has an entry in the hierarchy, so the two windows are inherently linked. The hierarchy reveals the structure of how GameObjects attach to each other.

(C) The Game view simulates what your final rendered game will look like through your Scene **Cameras**. When you click the Play button, the simulation begins.

(D) The Scene view allows you to visually navigate and edit your Scene. The **Scene view** can show a 3D or 2D perspective, depending on the type of Project you are working on.

(E) Overlays contain the basic tools for manipulating the Scene view and the GameObjects within it. You can also add custom Overlays to improve your workflow.

(F) The Inspector Window allows you to view and edit all the properties of the currently selected GameObject. Because different types of GameObjects have different sets of properties, the layout and contents of the **Inspector** window change each time you select a different GameObject.

(G) The Project window displays your library of Assets that are available to use in your Project. When you import Assets into your Project, they appear here.

(H) The status bar provides notifications about various Unity processes, and quick access to related tools and settings.

2.7.3.3 MAYA

Maya is a program, created by Autodesk, used to model, animate, and render 3D scenes. 3D scenes created with Maya have appeared in movies, television, advertisements, games, product visualizations, and on the Web.

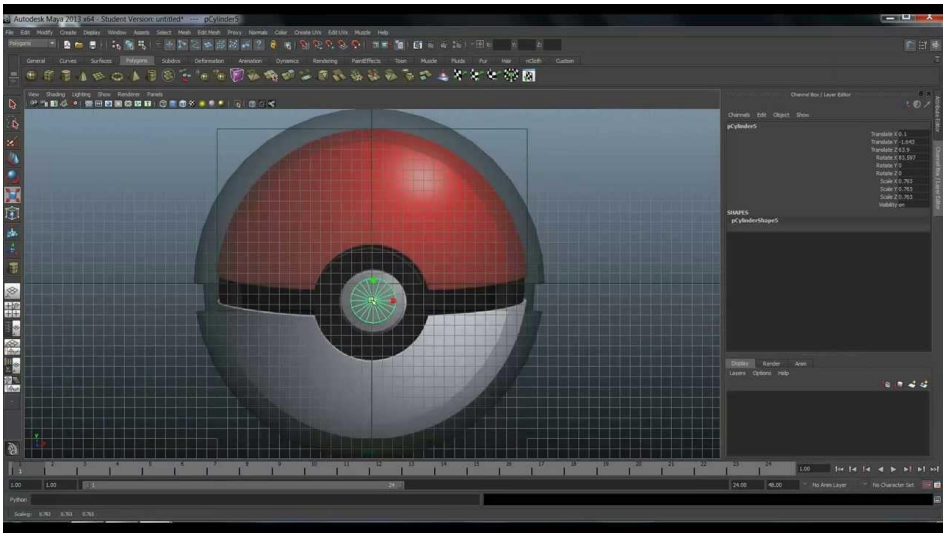

Fig 2.9.9.2 *Maya Interface*

- At first glance, the Maya interface can be a little daunting, with buttons, controls, and parameters everywhere, but if you look closer you'll realize that all of the controls are grouped into logical sets. Becoming familiar with these various sets of controls makes the interface much easier to work with.
- Along the top edge of the interface are the menus and a toolbar of buttons called the Status Line. The menus will change depending on the mode that you're working in. Below the Status Line is a tabbed row of buttons. This row of buttons is called the Shelf, and it offers a convenient way to group sets of commands together. To the right of the interface is a panel of parameters called the Channel Box. These parameters, known as attributes, will change as different objects are selected. Under the Channel Box is the Layer Editor.
- Along the bottom of the interface are the Time Slider, the Range Slider, and the animation controls, which are used to specify and move between the different frames of an animation sequence; also at the bottom are the Command Line, for entering textual commands, and the Helpline. Finally, the horizontal column of buttons to the left of the interface is known as the Toolbox and the Quick Layout buttons. These buttons are used to select and transform scene objects and to change the interface layout.
- A key concept that you need to understand as you begin to work with the interface is that there are several ways to access the same command. For example, you can create a sphere using the Create, Polygon Primitives, Sphere menu command or

by using the Polygon Sphere button in the Polygons shelf. This design is intentional, allowing beginners an intuitive method for accessing a command, and giving advanced users an access method that lets them work quicker as they learn the shortcuts. ′ One of the quickest ways to access advanced-user commands is with the Secret menus. These context-specific pop-up menus appear when you right-click in 20 the interface. Another quick way to access commands is with keyboard shortcuts, known as hotkeys.

- Maya gives users the option to customize the interface. Using the customization features, you can create a custom set of command icons, define keyboard shortcuts, and even alter menus. Many of the customization options are included in the Window, Settings/Preferences

2.7.3.4 VUFORIA SDK

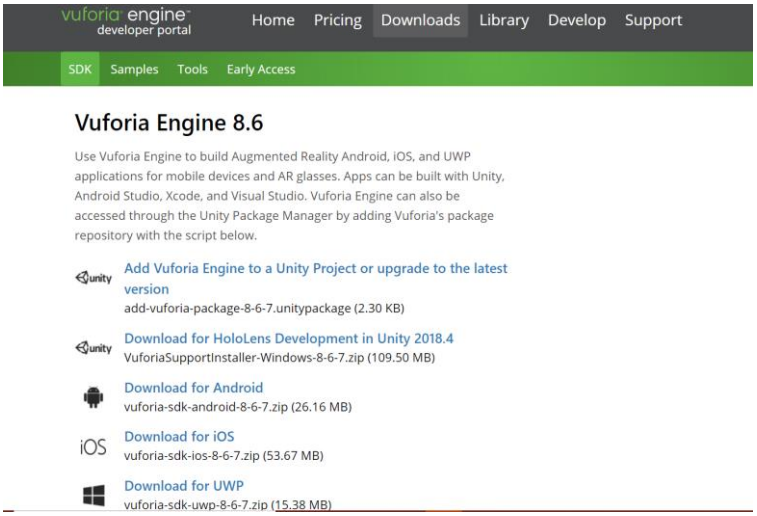

Fig 2.9.9.3 *Vuforia Engine*

Vuforia is an augmented reality software development kit for mobile devices that enables the creation of augmented reality applications. It uses computer vision technology to recognize and track planar images and simple 3D objects, such as boxes, in real time. This image registration capability enables developers to position and orient virtual objects, such as 3D models and other media, in relation to real world images when they are viewed through the camera of a mobile device. The virtual object then tracks the position and orientation of the image in real time so that the viewer's perspective on the object corresponds with the perspective on the Image Target. It thus appears that the virtual object is a part of the real world scene. The Vuforia SDK supports a variety of 2D and 3D target types including ‘markerless’ Image Targets, 3D Multi-Target configurations,

and a form of addressable Fiducial Marker, known as a VuMark. Additional features of the SDK include localized Occlusion Detection using ‘Virtual Buttons’, runtime image target selection, and the ability to create and reconfigure target sets programmatically at runtime.

2.4 AUGMENTED REALITY APPLICATIONS

Application	Description/explanation
Gaming	AR takes into consideration better gaming encounters as gaming grounds are being moved from virtual circles to incorporate genuine encounters where players can perform genuine exercises to play.
Retail and Advertisement	AR can improve customer experiences by presenting customers with 3D models of products and helping them make better choices by giving them virtual walkthroughs of products such as in a real estate. It can be used to lead customers to virtual stores and rooms. Customers can overlay the 3D items on their spaces such as when buying furniture to select items best suitable to match their spaces – regarding size, shape, color, and type. In advertising, ads can be included in AR content to help companies popularize their content to viewers.
Manufacturing and Maintenance	In maintenance, repair technicians can be directed remotely by professionals to do repairs and maintenance works while on the ground using AR apps without having the professionals travel on the location. This can be useful in places where it is hard to travel to the location.
Education	AR interactive models are used for training and learning.
Military	AR assists in advanced navigation and to help mark objects in real-time.

Tourism	AR assists in traveling the places and near-by locations.

2.5 CASE STUDY - Changdeok ARirang

2.5.1 BACKGROUND

"Changdeok ARirang," a new augmented reality (AR) application developed for Changdeok Palace, offers radical new ways for visitors to appreciate cultural heritage. Developed by SK Telecom in collaboration with Google Korea and the Cultural Heritage Administration (CHA), the application digitally recreates the royal palace with 5G AR technology.

"Contactless culture, ignited by the COVID-19 pandemic, is changing our way of life. I hope the AR Changdeok Palace project will provide an opportunity for people both inside and outside Korea to enjoy aspects of Korea, including traditional cultural heritage," Cultural Heritage Administrator Chung Jae-suk said.

Fig 2.9.9.4 *Changdeok Arirang App Interface*

2.5.2 TECHNOLOGY BEHIND CHANGDEOK ARirang

- Using 5G Mobile Edge Computing (MEC) & and AR to improve the visitors' experience of palaces with many physical barriers.
- Haechi, the symbol of Changdeokgung, a UNESCO heritage, becomes an AR docent and guides the various places of the palace through a navigation function

Fig 2.9.9.5 *Changdeok Arirang App Navigation,AR Theatre,AR Gaming*

2.5.2 FEATURES OF CHANGDEOK ARirang

The app also offers an up-close look at some of the off-limits spaces including the inside of Huijeongdang Hall and Huwon. Upon arriving at the entrance of Huwon, users will be teleported through an AR door to the Juhamnu Pavilion in the garden where Gyujanggak (royal library) is located.

Fig 2.9.9.6 *Changdeok Arirang Joseon Palace*

You can walk from the front of Changdeokgung Palace all the way to the back garden. There are a total of 12 guided paths, and the mythical Xiezhi will be the guide to tell you the history of Changdeokgung Palace.

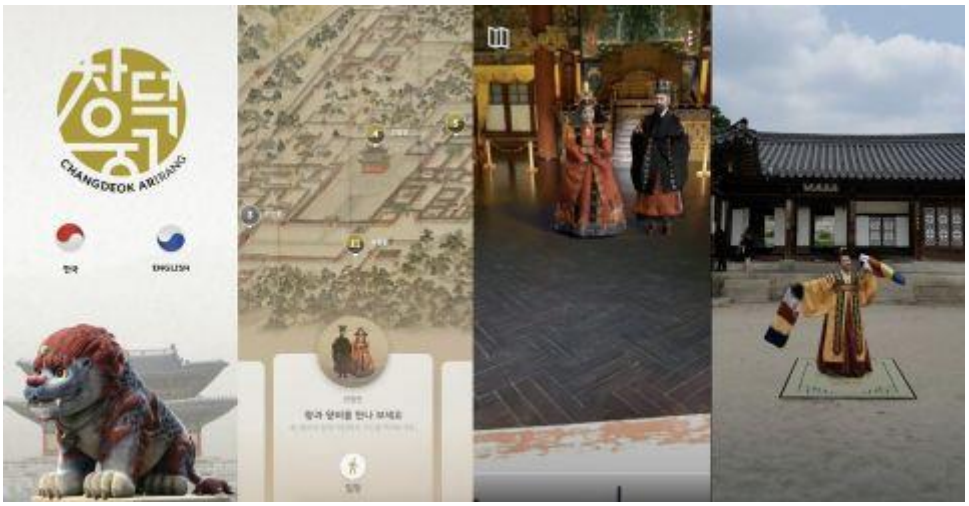

Fig 2.9.9.7 *Changdeok Arirang App User Interface*

Visitors can also take pictures with a Joseon king and queen through AR technology at Injeongjeon Hall and experience virtual archery and kite-flying. In front of Nakseonjae Hall, users can watch a performance of "Chunaengmu," a type of Joseon court dance.

Fig 2.9.9.8 *Changdeok Arirang Joseon King & Queen*

1. The application also provides barrier-free tourism at the palace, guiding visitors to available ramps that can be used instead of stairs.
2. The service is available through SK Telecom's 5G mobile edge computing (MEC) technology and Google Korea's cloud and AR technologies.
3. The application became available Tuesday for 5G smartphone devices. Those who don't have a 5G device can rent one at the palace.
4. Later in August, SK Telecom will release "Changdeok ARirang at Home," which offers AR and virtual reality (VR) viewing of the palace from any location. While "Changdeok ARirang" is for those who actually visit the palace, the home edition is for those who cannot come to the palace such as those in foreign countries or in vulnerable social groups.

Chapter 3

Project Methodology

Every project has a certain development methodology, right from base assets to testing phase. To develop an augmented reality application there's a rigorous model that has to be created. Finding, right customized assets to experience the AR effect , the Agile model is suitable for this project.

3.1 AGILE MODEL

"Agile process model" refers to **a software development approach based on iterative development**. Agile methods break tasks into smaller iterations, or parts do not directly involve long term planning. The project scope and requirements are laid down at the beginning of the development process.

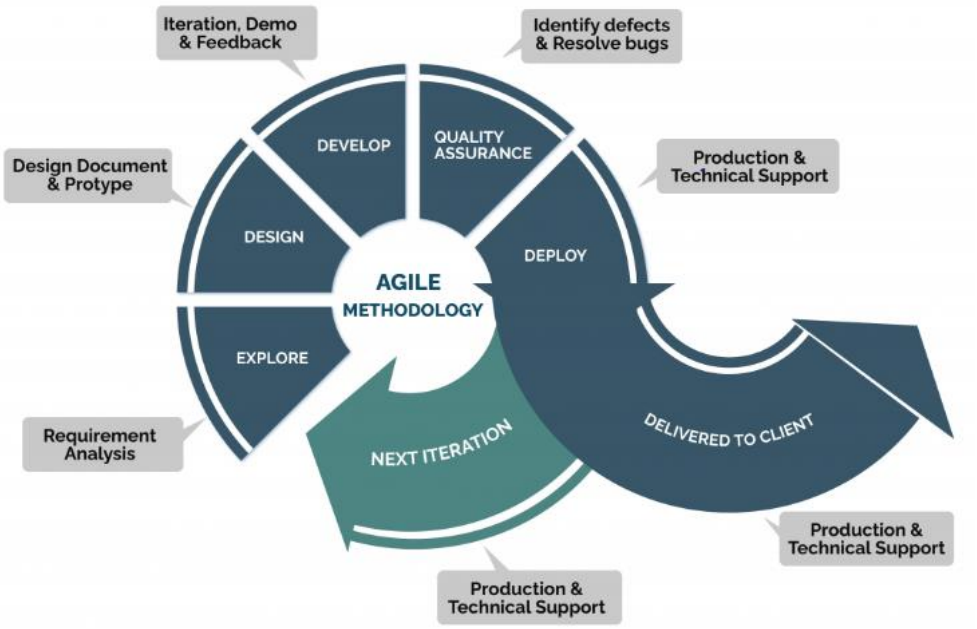

Fig 3.1 *Augmented Reality Agile Model*

The transition steps between the Exploring Stage to the Deploying Stage are summarized below.

1. The Roadmap for the deployment stage is backed by the research done in the exploring stage. The Roadmap specifies which areas the enterprise wants to explore, the budget and costs, and the feasibility study for each step.
2. Interested departments can jointly plan use case implementations and identify funding sources for AR work.

3.1.1Activities of the Deployment Stage

Strategic Activities

- AR software and hardware platform strategies are laid out.
- One or more use cases being deployed to solve business problems.
- Single or multi-departmental deployments.
- Operating models and governance frameworks are established.
- AR value drivers are being refined as a result of real experience.
- Involvement of corporate IT
- Security evaluations
- Mobile device management strategy definition

Technology Activities

- An AR software platform strategy is implemented or in the process of being rolled out.
- A use case-driven device strategy is established, including smartphones, tablets, and smart glasses.
- Video calling – The collaboration mechanism and tools between tech & experts, for example, are rolled out along with clearly defined objectives.
- Augmented task flows are laid out.
- The content strategy for AR is defined.
- Collect and act on AR analytics.
- Start to consider IoT use cases.

Content Activities

- Augmented Digital Task Flows are designed and executed.
- Existing 2D and 3D content assets are leveraged and new value created.

3.2 HOW WE USED AGILE MODEL

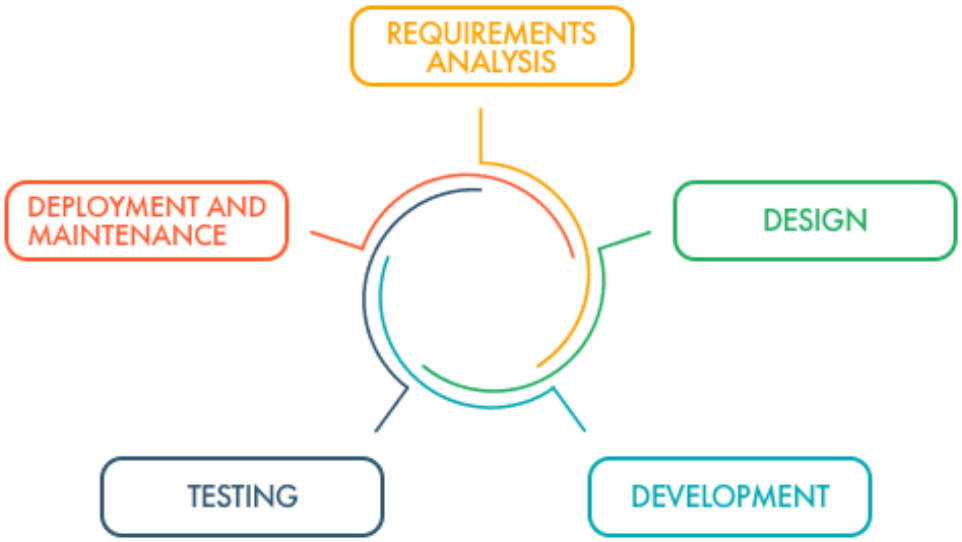

Fig 3.2 *Phases of Agile Model*

- Requirement Analysis : AR Softwares i.e., Spark AR,Unity
- Design : 2D UI Elements,3D Models, Background environment design.
- Development : Programming Languages i.e., C#,Java Script
- Testing : Android/IOS Mobile
- Deployment : Any changes in model or any buugs found again iterating the process and finalizing it.

3.2.1 DESIGN METHODOLOGY

One of the main activities in Augmented Reality user interface development, which is inherently multimodal, is the experimentation with different interaction techniques because it is such a young field. These have to be designed, implemented and evaluated. An important research issue here is to establish a development methodology that covers these three sub-activities and links them together more closely. We believe the main

groups of developers participating in Augmented Reality user interface development (Figure 1) are:

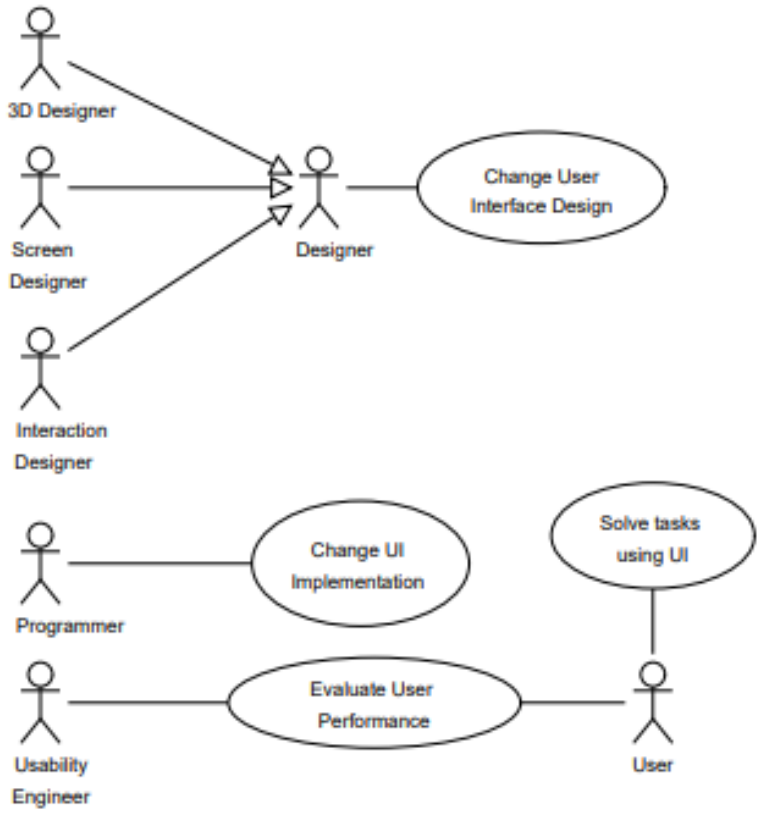

Fig 3.3 User Interaction Each phase in AR

- **Programmer** The programmer changes the implementation of the user interface by writing and editing low level code.
- **3D Designer** This type of designer is concerned with creating 3D interaction / presentation elements which are to make an appearance in the user interface. An example for a 3D presentation element might be the landscape for SHEEP [11].
- **Screen Designer** The focus of this designer is the actual screen layout, that is what is presented to the user at which location on screen.
- **Interaction Designer** This designer wants to fine-tune the interactions the user can experience. She will set which multimodal inputs trigger which actions.
- **Usability Engineer** This person combines all the roles of conducting usability studies in one. He selects, briefs, and debriefs the users for the study, prepares the evaluation materials, conducts and logs the actual study and finally analyzes and evaluates the results.
- **User** The user actually uses the user interface by navigating through it in an

attempt to accomplish certain tasks. For example she might want to place a roof on a building she is constructing within an architectural Augmented Reality application.

3.2.2 THE PROBLEM

The development of Augmented Reality user interfaces requires special attention for multiple issues. These issues are presented in this section. Process Issues In traditional user interface development, a waterfall or an extended waterfall process (Figure 2) is followed . Starting with the phase design, it is proceeded to the phase implementation and finally a phase evaluation. These phases are run highly sequential with no or little room for feedback or dependencies. This type of process works well if you have enough details about the design space and in general can anticipate implications of design changes well in advance.

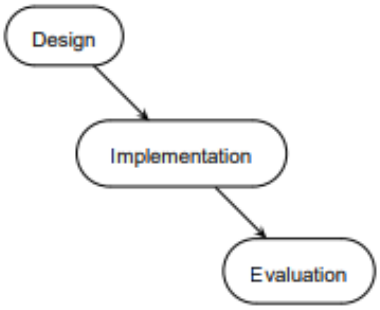

Fig 3.4 *AR SDLC Phase problem*

3.2.3 RESEARCH CHALLENGES

The previously identified problems result in a number of research challenges on all areas tools, process and on the methodology as a whole which are the focus of this section. On tools the main questions are:

• **Which tools** There are numerous paths to take in supporting the main three user groups, resulting in a large design space for tools. It is a challenge to gain clarity regarding which type of tools will have the largest benefit.

• **Tool integration** By integrating tools with each other, a much better work-flow between these tools can be leveraged building on tool chains. Where are the limits to integration and which integrations are reasonable at all?

• **Tool mapping** Some tools might be useful to more than one user group thanks to a high

level of integration. The presentation of multiple tools simultaneously to certain user groups might have more value, than the sum of each single tool on it's own merit. It is a challenge to figure out which tool combinations map best to which user groups.

• **Tool automation** The more knowledge on UI design is accumulated, the more ideas for automation features in tools can be generated. For example, basic clear cut design principles which have been shown to apply in certain scenarios could be enforced in design tools. Since we still lack knowledge in this area, it is unclear which automations will be indeed feasible in the future. Instead of testing against known usability problems, there have been interesting approaches in web interface development, like WebRemUSINE , which try to automatically identify new usability problems. This is done by looking at the level of correspondence between how users actually perform tasks and the intended system task model. This idea might also be applicable to Augmented Reality user interfaces.

3.2.4 TOOLS TO CREATE MAR

ARCore:

ARCore is an AR SDK for Android platforms developed by Google and released in 2017. ARCore requires an Android version of 7.0 or later depending on the device and supports over 140 different device models ARCore is constantly expanding the available devices for ARCore. ARCore can also be used for AR experiences on the Chrome web browser (Medley, 2019). To some extent, ARCore can be utilized to build applications to iOS through Cloud Anchors with Unity, however, the SDK still needs an ARKit compatible device running iOS 11 or later. ARCore maps the environment through the camera and uses simultaneous localization and mapping (SLAM) technology to do so. The tools used for developing with ARCore listed on Google Developers are Android Studio, Unity, Unreal Engine and Xcode. Xcode, however, only supports the ARCore Cloud Anchors and does not replace ARKit for iOS devices.

ARKit :

Released in 2017, ARKit is an AR SDK for iOS devices, developed by Apple. iOS is the largest AR platform . Apple released ARKit 2 in 2018 for iOS 12.0+ devices which allows AR experiences to be run on the Safari web browser. Features in ARKit include the ability to use both the back- and front-facing camera for AR experiences. To

create the AR experience, ARKit uses visual inertial odometry (VIO) technology for a correspondence between real and virtual spaces . Utilizing a front-facing camera with a TrueDepth, like iPhone X possesses, ARKit can track the movement and facial expressions of a user which can be used to augment virtual masks on a user. A popular example of this is Snapchat filters. ARKit plugins for other applications 16 are not available to download, however, Unity and Unreal Engine do have support for ARKit on their platforms.

Vuforia:

Vuforia Engine, acquired by PTC Inc. in 2015, is one of the most widely deployed AR platforms, supporting both Android and iOS as well as wearable technology. Vuforia Fusion, a feature found in Vuforia Engine 7 and later can use the APIs of ARKit and ARCore on applicable devices Vuforia provides powerful features such as extended tracking to maintain a reference point of an augmented object outside the view of the camera and localized occlusion detection for use in virtual buttons. Furthermore, Vuforia can recognize and track text from a set word database, which could be used for real-time translation. The Vuforia SDK can be downloaded for development use with Android Studio, Unity, and XCode free of charge. Alternatively, Vuforia Engine can also be used with PTC's Vuforia Studio, a web-based creation tool for the Google Chrome browser, which features drag-and-drop functionality for content For Vuforia to run on a mobile device, an Android version of 4.4, iOS version of 11.0 or Windows 10 is needed.

Wikitude:

Wikitude was established in 2008 when Wikitude published Wikitude World Browser, the world's first MAR application for first Android phone, Android G1, also known as HTC Dream. Since then, Wikitude has expanded into one of the most popular AR providers, providing support for smartphones, tablets and eyewear. Wikitude's computer vision software includes three major parts. The SLAM engine, Image Rrecognition Engine and the Object Recognition Engine. Similar to Vuforia, Wikitude can use ARCore and ARKit APIs as plugins to the Wikitude SDK. The Wikitude SDK is available to Android and iOS with JavaScript and Native support and UWP with Native support. Additionally, Wikitude provides extensions for Unity, Xamarin, Titanium and Cordova.Wikitude requires a minimum version of Android 4.4, iOS 9.0 or Windows 10

to run. Wikitude also offers Wikitude Studio, a web-based creation tool with similar features to Vuforia Studio as a development platform.

EasyAR :

EasyAR, featured in the 2016 Augmented World Expo is developed by Visionstar Information Technology and offers a completely free SDK for commercial use. Vuforia and Wikitude offer free development licences, however, to publish the application a paid licence is needed. EasyAR does offer a paid version with more features than the free counterpart. EasyAR uses SLAM technology for spatial tracking, however, it is not available in the free version. Other features in the paid version include 3D object tracking, screen recording and multi-type of target simultaneous detection and tracking. The free version, on the other hand, still provides marker-based image tracking and multi-target detection and tracking. EasyAR has the lowest operating system requirements for AR out of the selected SDKs, requiring Android 4.0, iOS 7.0 or Windows 7. As EasyAR does not generally rely on operating system APIs, it will work on newer release versions of Android and iOS. EasyAR is available for Android, iOS, Windows, macOS and Unity.

	Vuforia	Wikitude	ARKit	ARCore	EasyAR	8th Wall
Utility						
Marker-based	x	x	x	x	x	x
Markerless	x	x	x	x	x	x
Projection-based	-	-	-	-	-	-
Superimposition	x	x	x	-	x	-
Minimum platform version						
Android	4.4	4.4	-	7.0	4.0	4.4
iOS	11.0	9.0	11.0	11.0	7.0	7.0
UWP	10	10	-	-	7	-

Fig 3.5 *Comparative analysis of ARkit, ARcore, Vuforia Engine, Wikitude, EasyAR*

3.3 DESIGN GUIDELINES

- There are several technical limitations in AR technology in the meantime. The most advanced and commercially available device is probably Microsoft HoloLens.
- Many types of devices are out there, but some of them are still clunky and their potential is not fully reached. One of the biggest limitations is that the device itself is quite big.
- Mostly it is wearable headset or glasses. Besides that, voice and gesture recognition is not perfect either. Voice and gesture commands are as simple as possible.
- More complicated commands can be easily misrepresented or lead to the error state. Field of view on such devices is constrained. This makes it harder for the designer, because of bounded space where the content can be shown.

Fig 3.6 *Color Scheme Analysis of AR*

Recently, the design trend has favored minimalism and simple text or colored regions. A well-designed website will use color, distance, and typography to clearly communicate a purpose and often persuade some sort of action. Contrasting elements of sight like light, color, and motion naturally draw users' attention.

3.3.1 PRESENTATION

Combination of 2D and 3D design paradigm

UI design is used to prefer 2D design paradigm. It is common, because of flat screens on many information technology devices people are using, from notebooks, tablets to smartphones and smart watches. On the other side in VR this 2D UI can feel confusing or unnatural. There is often used 3D paradigm or combination of those two.

Immediate content should be shown only in natural viewing zones.

3.2 DEVELOPMENT FRAMEWORK

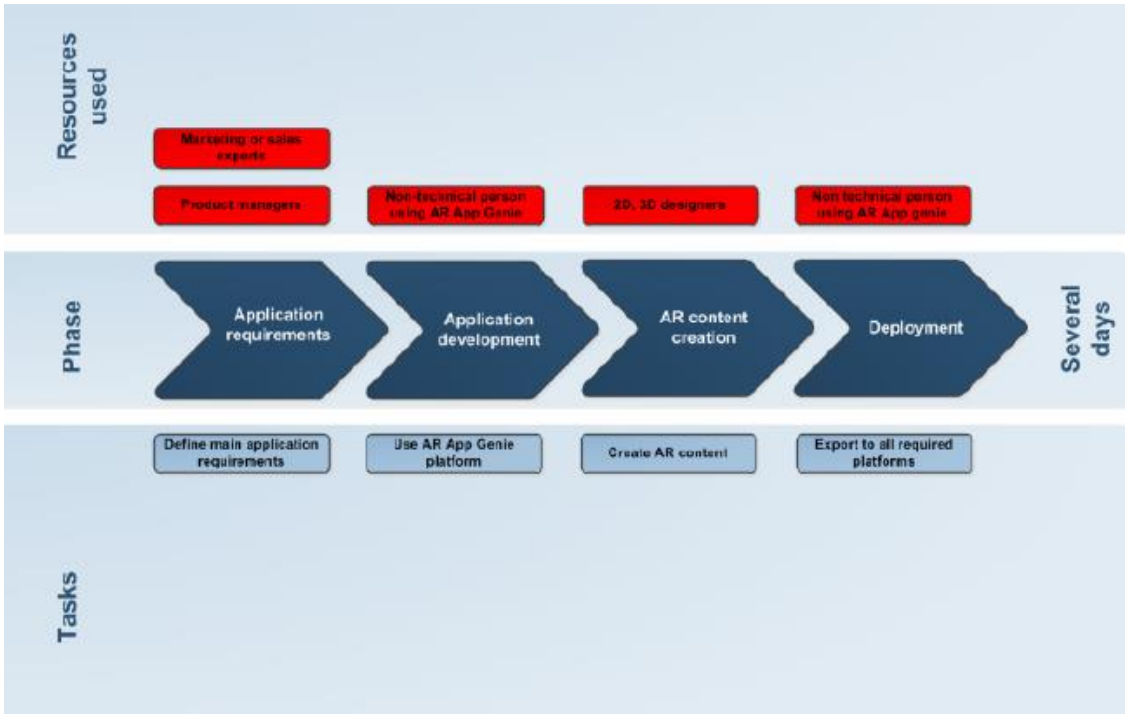

Fig 3.7 *Development stages*

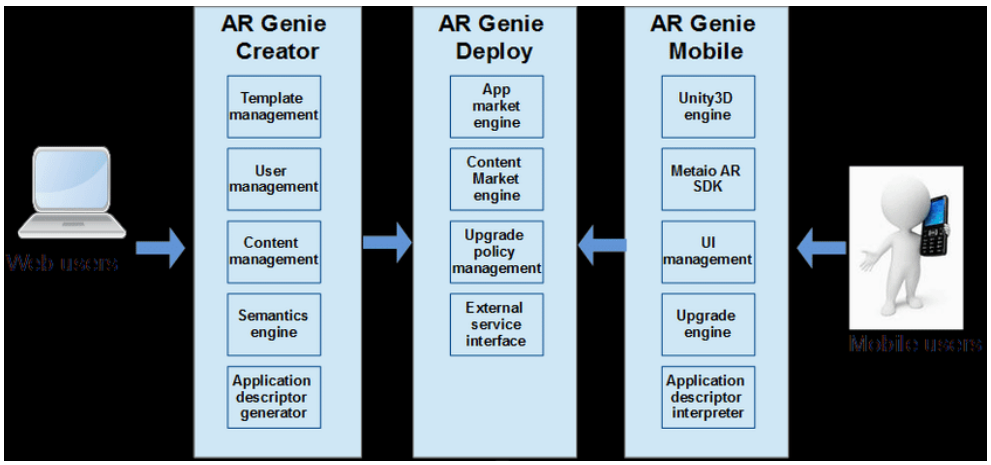

Fig 3.8 *AR Dev 3 Type -Phases*

3.3 CAPABILITIES OF SPARK AR

Capability	Supported	Details
Audio	✓	Add sounds to your projects using Spark AR Studio's audio tools (**Audio Documentation**)
CameraControl	✓	Control the camera (device position/etc)
CameraShare	✗	**Share information from third-party apps and pass it to effects**
CaptureEvent	✓	Capture state information about the camera (is capturing photo/is recording video)
Date	✗	Get and use the current date
DeepLinkTexture	✗	**Share textures from third-party apps and pass them to effects**
FaceTracking	✓	Track 1 or more faces (**technical documentation**) + (High-level **documentation**)
FrameBrightness	✗	Return the average frame brightness
GestureEvent	✓	Detect gestures / touch functionality + (**technical documentation for gesture class**)
Instructions	✓	Enable effects to provide instructions to the user. (**InstructionModule class documentation**) + (**high-level automatic instruction documentation**)
LiveStreaming	✗	**Lets you pull data from a live stream into the effect**
Locale	✗	**Expose Device locale information**
Motion	✓	Ability to capture information from the Gyro/accelerometer for World Tracking and standalone
Music	✗	Expose current playing "song" information into the effect
Network	✗	Ability to have your own server and send/recieve information - General purpose HTTP requests
OpticalFlow	✗	Ability to detect in which direction pixels are moving. For instance, when using particles systems, use the opticalflow to influence particle direction with movement
Persistence	✓	Store information within an effect for a specific user (e.g. a previous high score)
PlatformEvents	✓	Ability to retrieve information about what platform users are on
RandomGenerator	✓	Ability to generate random values
TargetRecognition	✗	Enables AI 2D target recognition using server side communication
Horizontal plane tracking	✓	Horizontal plane tracking
Vertical plane tracking	✗	Vertical plane tracking - Create content that's contextually tied to images, logos, signs and pictures in the real world
Video	✓	Ability to use video / load external video, but cannot use sound
Weather	✗	Provides current location's weather info into effects (**Weather Module**)

Fig 3.9 *Capabilities of AR*

Chapter 4

Implementation

There are a total of 6 categories in this project. Now, We will look into each category and its development process

4.1 CATEGORY 1 - FACE TRACKING (AR FILTERS)

- In Spark AR Studio, use the face tracker to create an effect that responds to someone's face.
- When a face tracker is combined with a face mesh, it creates a surface that can detect facial movements and expressions. You can add a material to the face mesh to create a mask effect.

4.1.1 UI ELEMENTS

1. Designing a filter png that you want to showcase in AR.
2. In this case avatar movie filer PNG is instigated.
3. Make sure the filter is in the correct shape of face.
4. Add all elements that are relevant to the filter.

Fig 4.1 *Avatar Face Mask Element*

4.1.2 DEVELOPMENT FRAMEWORK

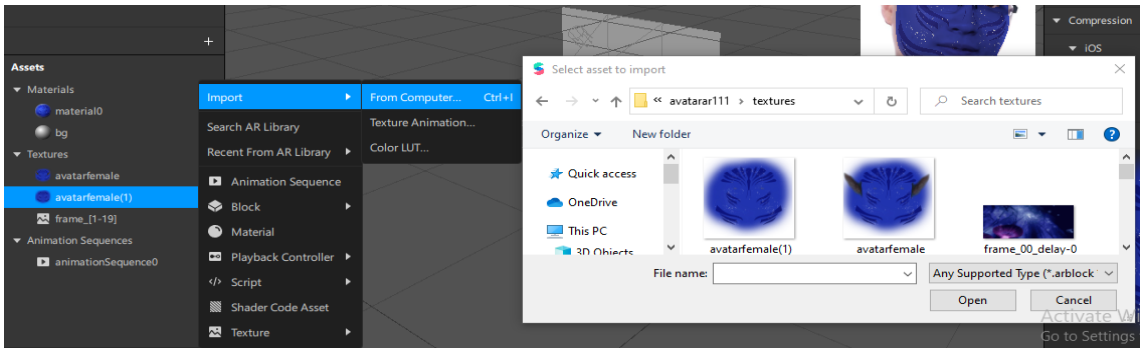

Fig 4.2 *Importing AR Filter*

- In the Asset Panel, importing the AR filter that need to be track the face
- Make sure while importing the filter it should be in PNG format.
- Creating Material Element and assigning texture into it.

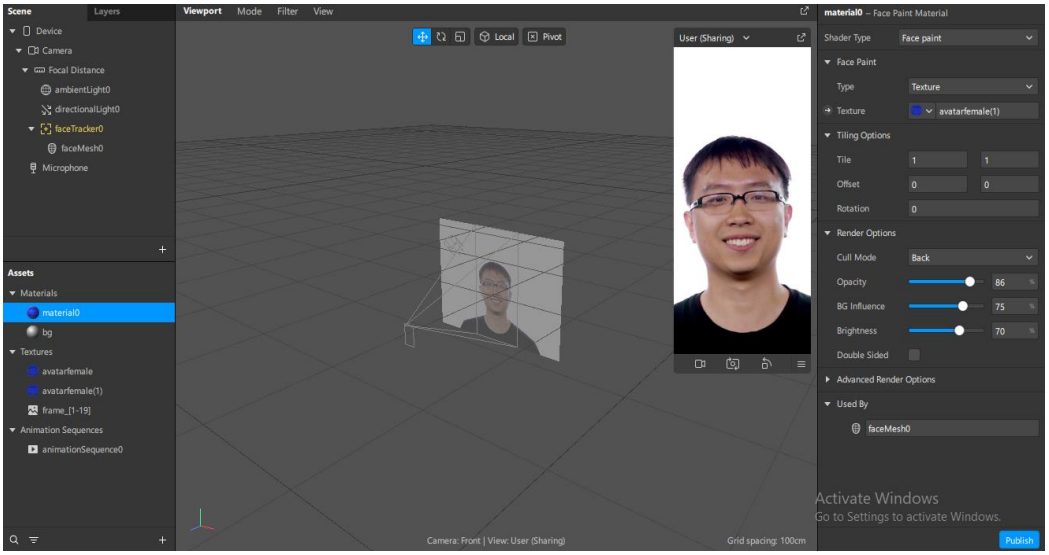

Fig 4.3 *Assigning material texture*

- Importing Face Tracker and Face mesh into the scene.
- Importing Face mesh into the scene and creating material for it.
- Assign the material that we created in the asset panel.

- Making sure all the scale, position values are correct to what we created in the asset panel.
- Creating a new layer to the face mesh , makes it more interactable and avoids the confusion.

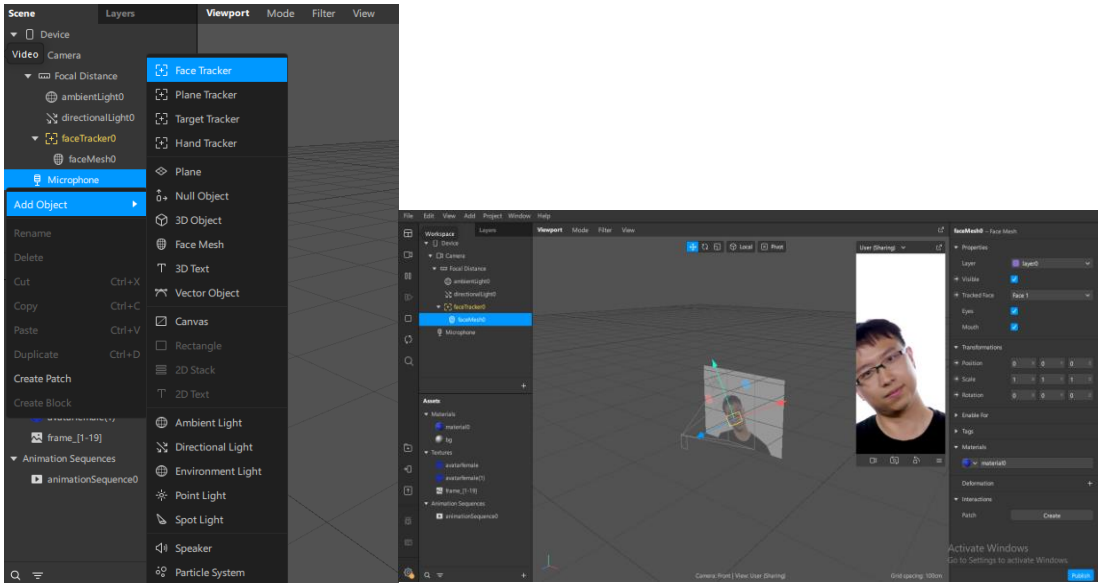

Fig 4.4 *Importing Face Tracker and Face plane*

Now, select one of the faces in the camera tool and by default the properties of face mesh will be added to the camera and user testing face.

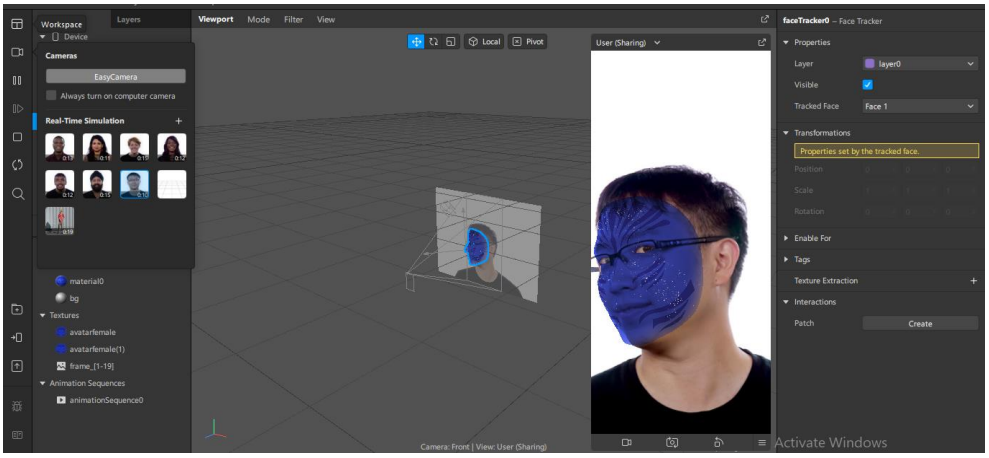

Fig 4.5 *Changing the properties of Face filter.*

- Now, make sure the face mesh is inside of face tracker as child of the parent object.

- After that the assets should be in KB , because the supported platform instagram supports only in MB.
- Now, we can export it into the SPARKAR Hub platform.

4.1.3 EXPORTING AND PUBLISHING THE EFFECT

- After clicking on the publish button, make sure to add what kind of experiencing what we are sharing. i.e., SHARING EXPERIENCE / VIDEO EXPERIENCE.
- After exporting it into AR PROJECT FILE, system checks its requirements and file sizes to upload it in the right format.

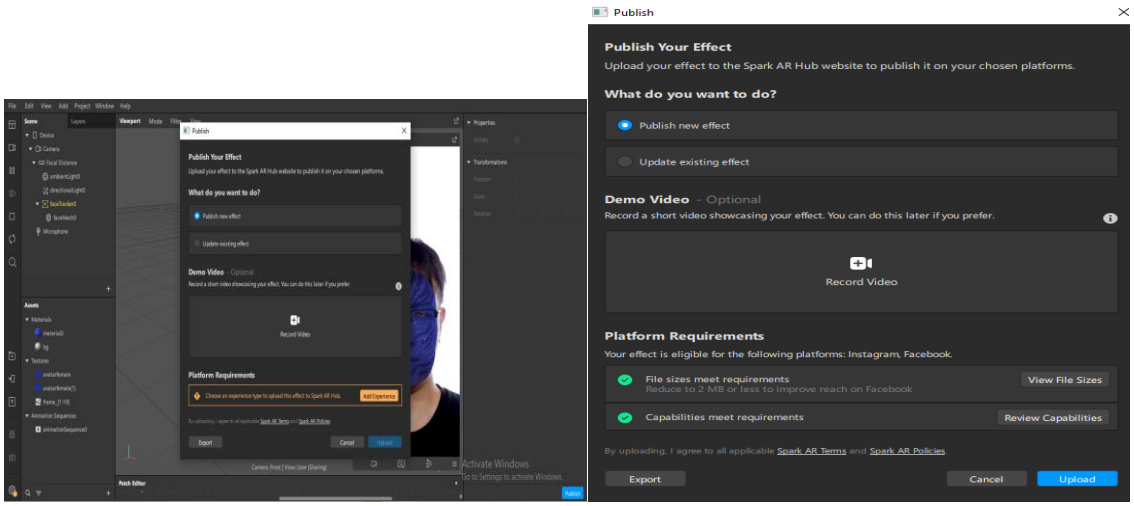

Fig 4.6 Exporting into AR export file size and requirements

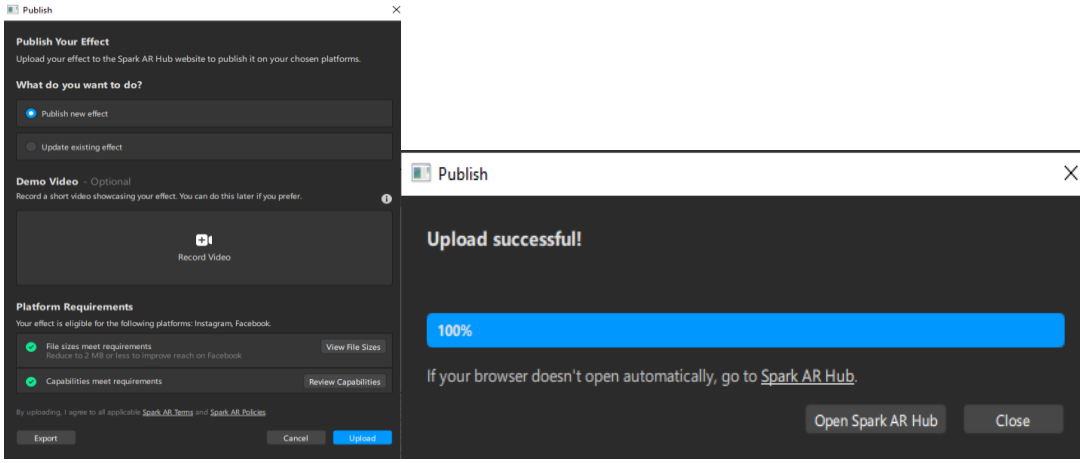

Fig 4.7 *Checking File sizes and uploaded successfully*

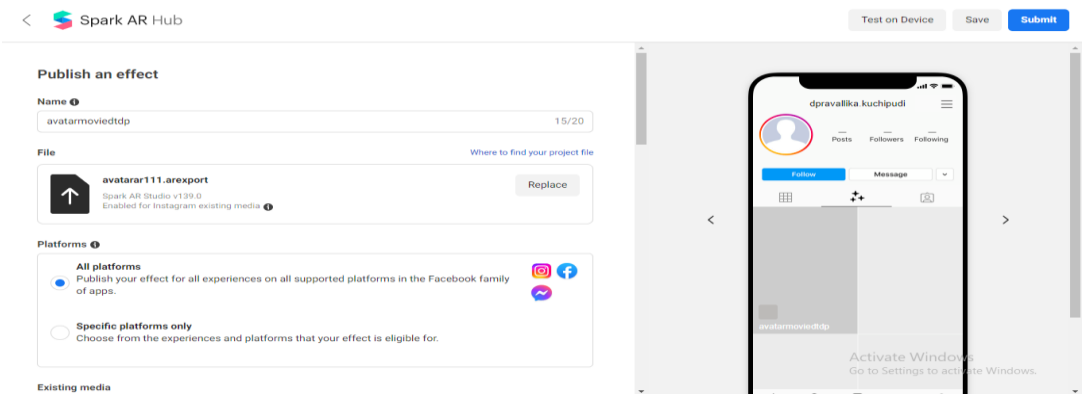

Fig 4.7 *Name the effect that needs to be published in Instagram platform*

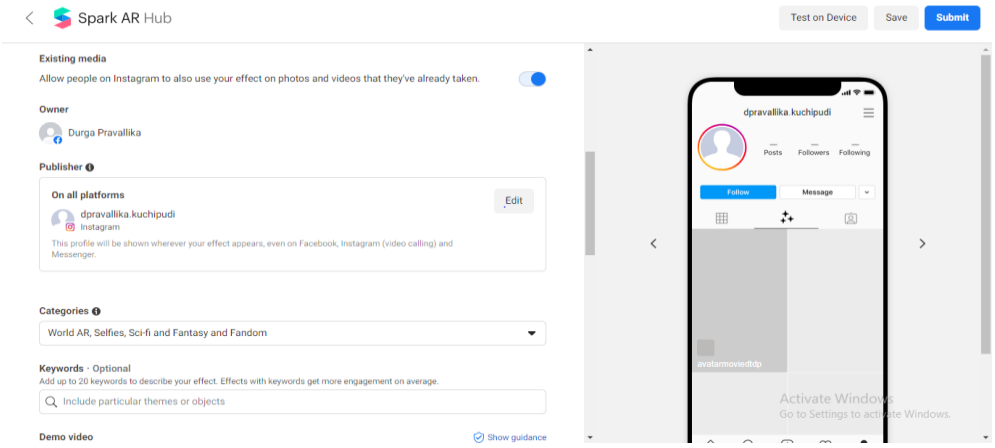

Fig 4.8 *Entering the keywords for the experience*

.

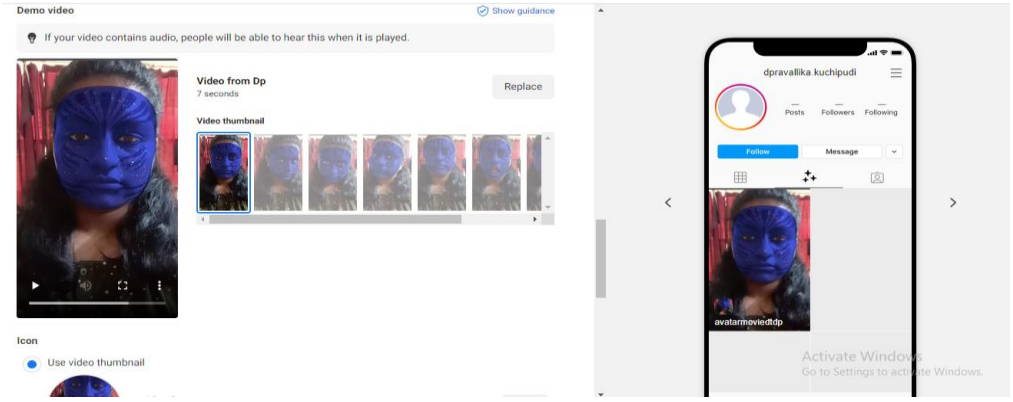

Fig 4.9 *Importing the Demo Video*

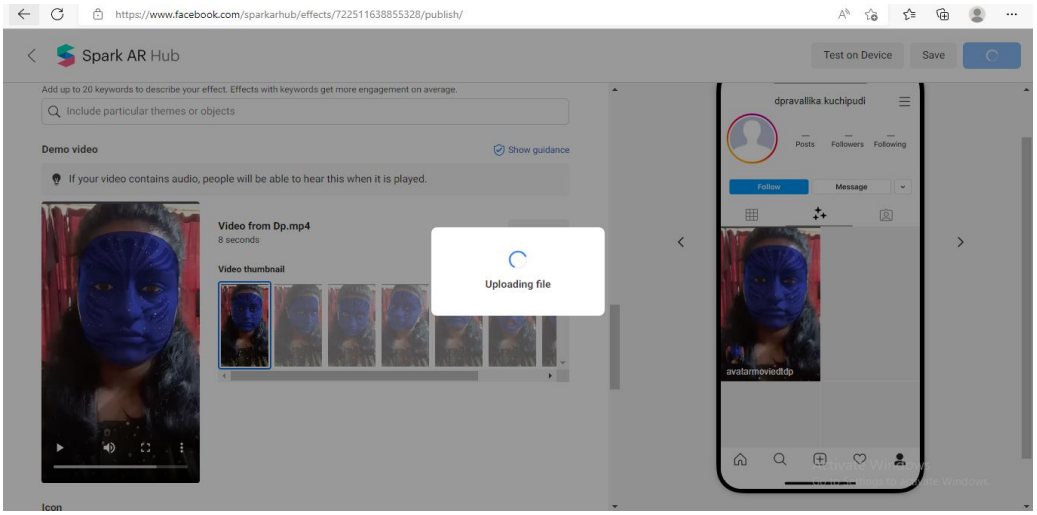

Fig 4.9.1 *Submitting the Experience*

After clicking on the right -corner SUBMIT button the filter will be uploaded.

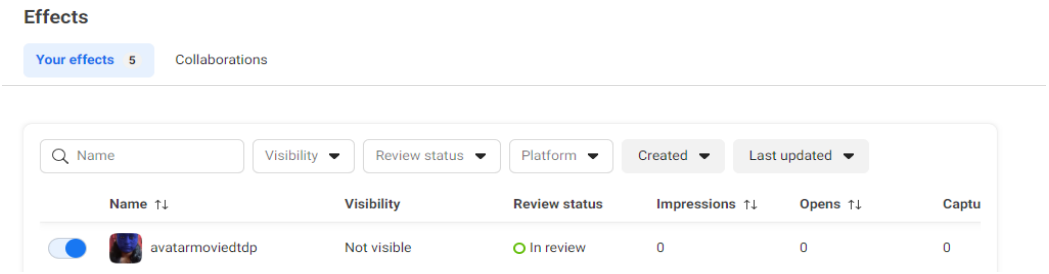

Fig 4.9.2 *Updating in DashBoard*

Then, automatically get into dashboard tab whether the effect was uploaded or not.

4.2 CATEGORY 2 - OUTLINER (AR SOBEL FILTER)

Sobel Filter/ Operator is a filter used in Convolution that is used to detect edges in an image. This is one of the fundamental approaches in Image Processing/ Machine Learning to detect edges.

4.2.1 UI ELEMENTS

Sobel Filter helps in detecting the edges in an image. Based on this, creating an AR Filter i.e., outliner. For, this it doesn't need any UI Elements. Have to work with patch

editor and manipulate the elements.

4.2.2 DEVELOPMENT FRAMEWORK

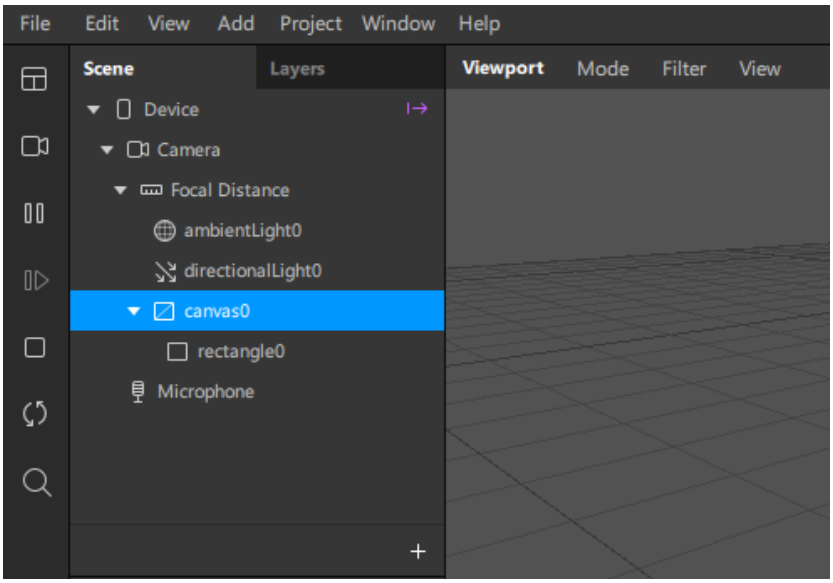

Fig 4.2.1 *Entering the keywords for the experience*

In Spark AR studio, we are creating a Canva in scene panel and rectangle, and we are making rectangle as child for Canva parent object.

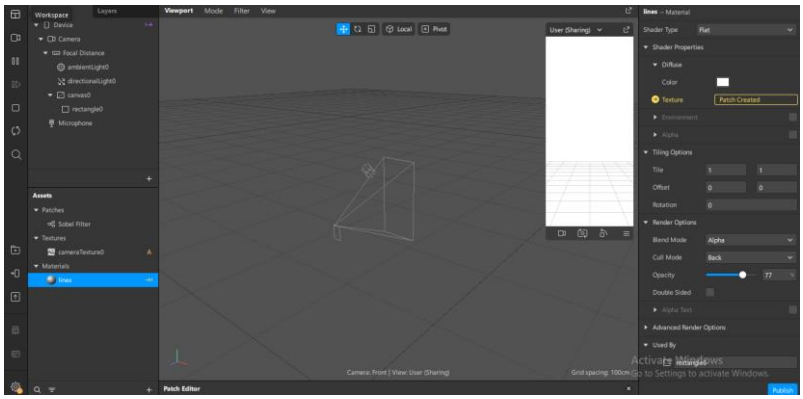

Fig 4.2.2 *Initiating the Material and texture*

In asset panel, creating a material and changing it into white color , and also creating the Camera texture under texture parent object.

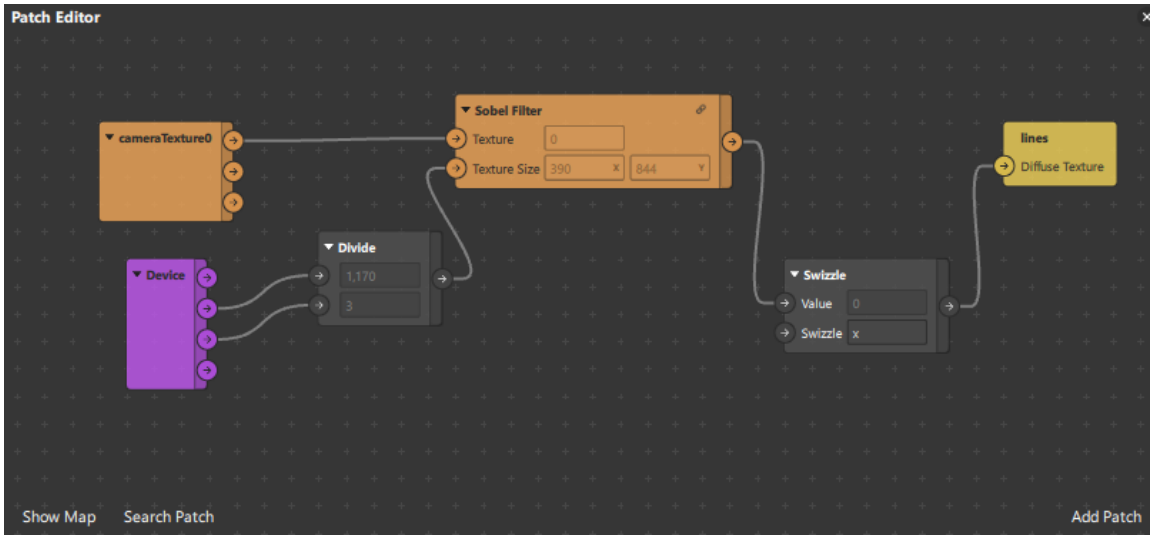

Fig 4.2.3 *Patch Editor for Outliner*

4.2.2.1.Camera Texture

When someone is using an AR effect in the camera, a live video is being captured. You can play this video back live as a texture in the scene. Everything the camera detects will be extracted, with the aspect ratio of the device.

4.2.2.2.Device

The device is an object that's automatically listed in the Scene panel in every Spark AR Studio project. It represents the device showing the effect, which means it can’t be removed from a project.

4.2.2.3.Divide

Divides one value by another value.

4.2.2.4.Sobel Filter

It contains the texture and texture size it detects the edges and it renders the camera texture.

4.2.2.5.Swizzle

Takes inputs values and outputs them in a different order or arrangement. After connecting these al-together as shown in patch editor and connecting them all together in lines material, that created in asset panel.

In rectangle object which is in scene panel, we are modifying properties of width and height changing them into relative instead of fixed. This makes it detecting the objects

easily, and also modifying the material and initiating it into lines material and changing the position to X,Y axis to -10,-10 helps in making more easily detectable.

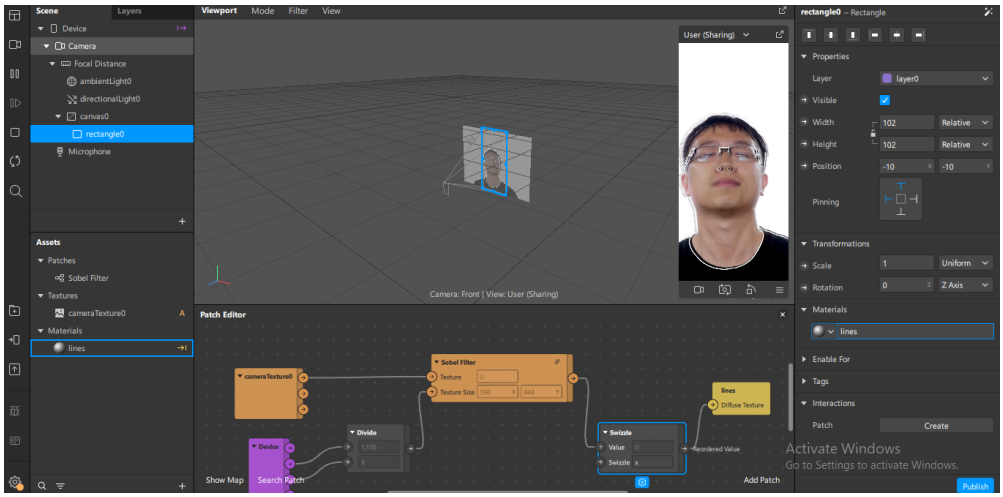

Fig 4.2.4 *Patch Editor Elements*

This is the patch editor elements that created for sober filter.

4.2.3 EXPORTING AND PUBLISHING THE EFFECT

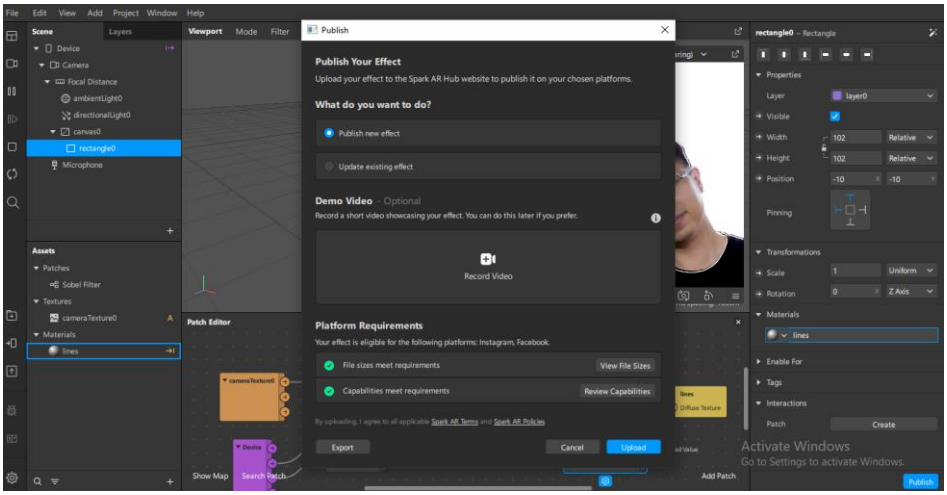

Fig 4.2.5 *Exporting Outliner filter*

After done with patch editor and assets and scene elements and their properties manipulation. Ready with publishing the filter, after changing it into AR sharing experience the system checks it's requirements ready with exporting. It automatically re-directs into Spark AR Hub after clicking the Upload button.

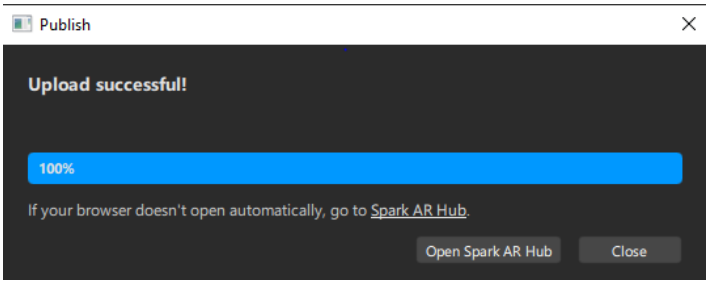

Fig 4.2.6 *Outlier exported successfully*

Filter was uploaded completely and redirected into SPARK AR Hub.

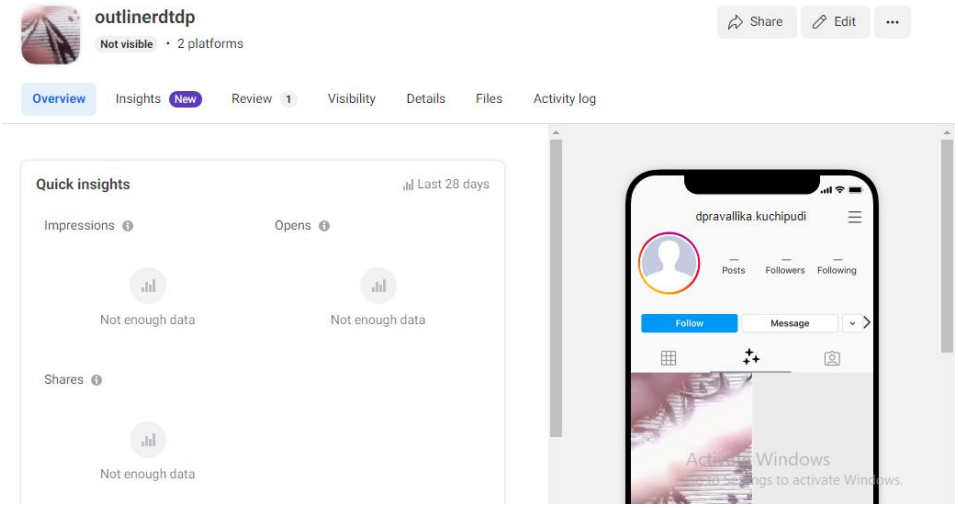

Fig 4.2.7 *After publishing the effect, it will successfully upload into Instagram platform.*

4.3 Category 3 Game (Body Tracking AR Filter)

Using the new 2D body tracking capabilities, you can now anchor effects to parts of the body, like arms and legs, and up to 20 different key points (or joints), like elbows or knees. And your effects can be applied to a single person, multiple people, or to partial parts of a body in a scene.

To help make effect creation easier, we're also introducing new body tracking patches. How you use them will depend on which key points of the body you want to track:

1. **Body landmark patches** track specific parts of the user's body, from head to toe. For example, you could use these patches to create line trail effects where particles emit from certain joints.
2. **Body bounding box patch** tracks the top and bottom corners of the user's body creating an invisible rectangle, or bounding box. You could use this patch to create, for example, a body swapping effect.

4.3.1 UI ELEMENTS

For this body tracking game, there needs to be 3 elements have added

1. Metaverse Background
2. Pokemon Ball 3D Model
3. Neon circles to detect the key points of the body to hold the tracking and score the points.

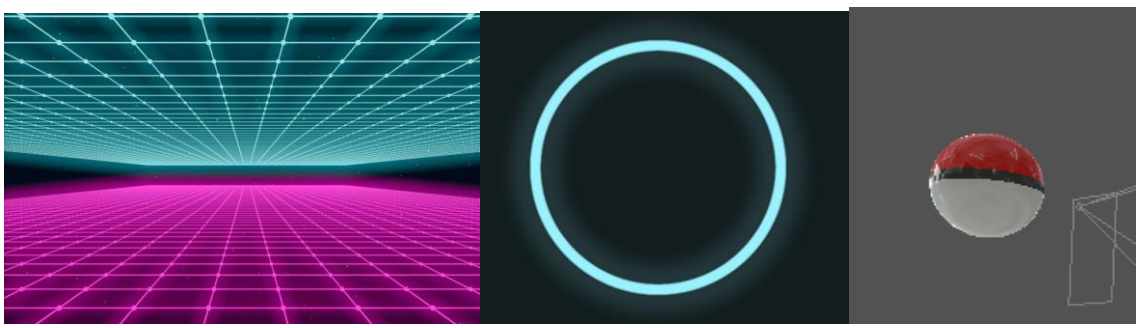

Fig 4.3.1 *UI Elements background,neon joins,pokemon 3D Ball*

4.3.2 DEVELOPMENT FRAMEWORK

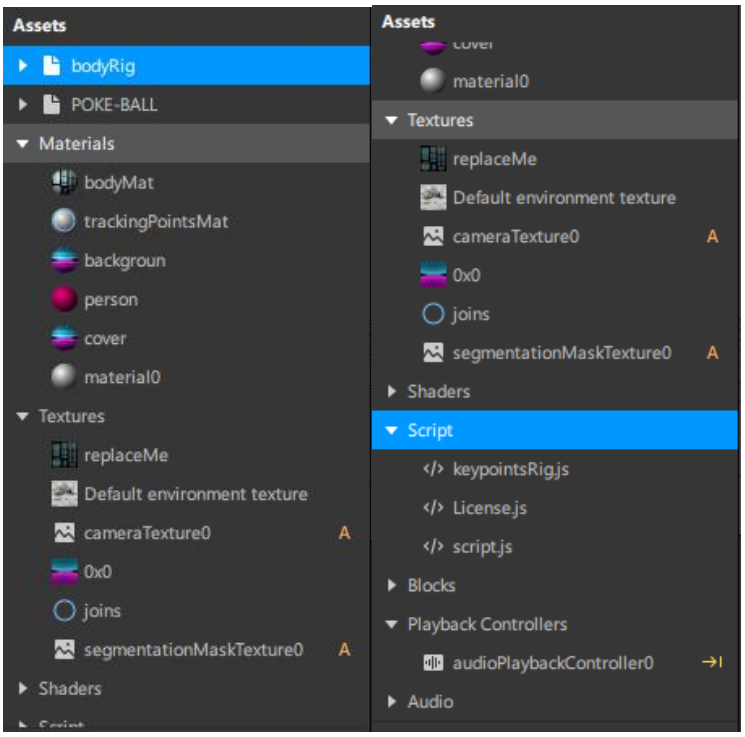

Fig 4.3.2 *Body Rig and Java Script, Audio playback controller in Assets panel*

As shown in assets panel, there are metaverse background,and joins 2D element to detect the right wrist, left wrist,right knee,left knee, top of head, and script to count the number of times the ball entered into joins element, and sound to playback for the interaction of score added.

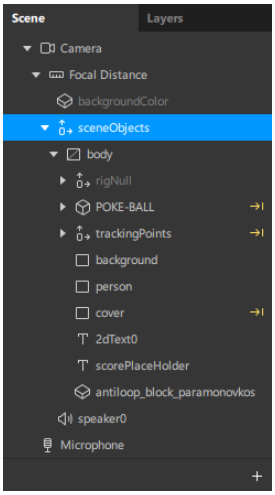

Fig 4.3.3 *Parent and child objects for body tracking AR*

As we can see in the scene panel, the Pokémon 3d ball and tracking points i.e., right wrist,left wrist,right knee,left knee,top of the head are the tracking points and the the rectangles named background,person,cover and the two layers of 2d text and for score count there's this named layer scorePlaceHolder which again will be used in script to calculate the score and a speaker is added to count the score .

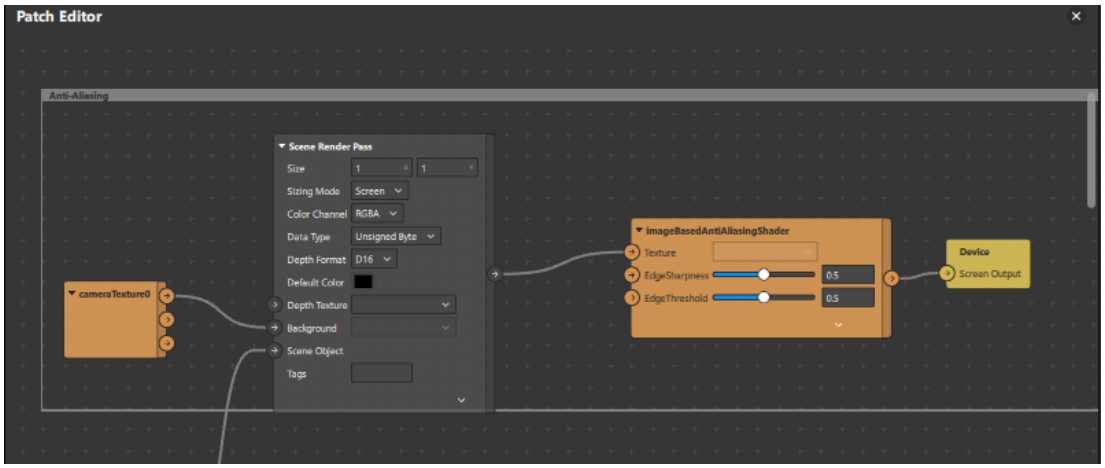

Fig 4.3.4 *Elements for Animation*

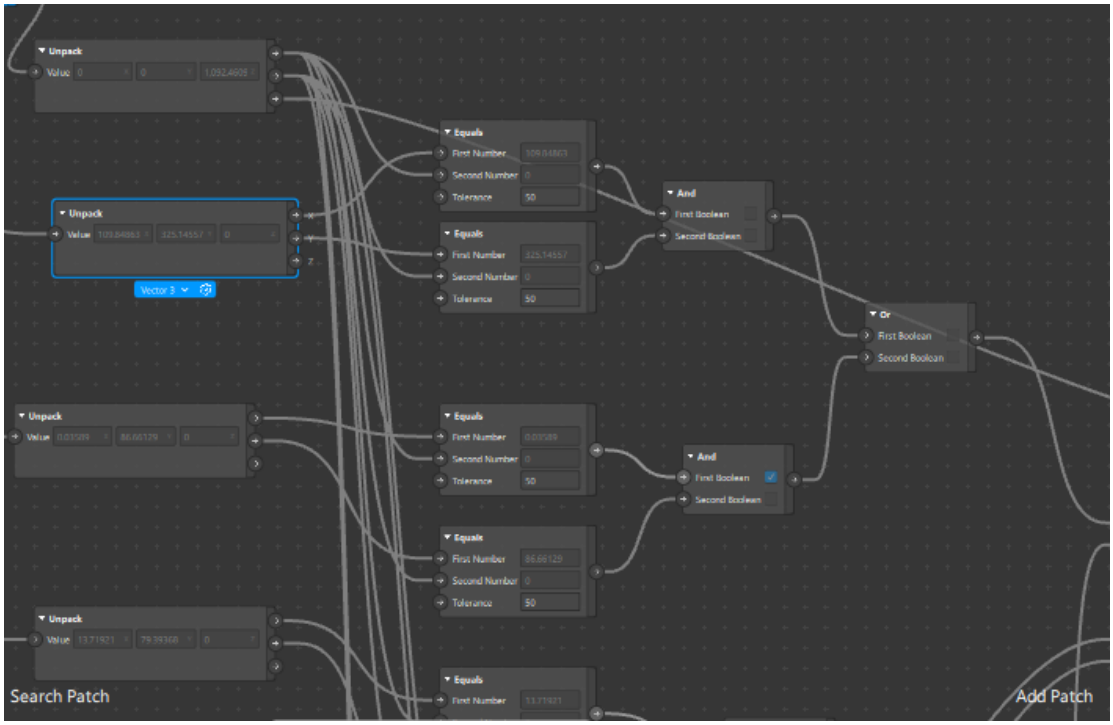

Fig 4.3.5 *Key Joins on/off patches*

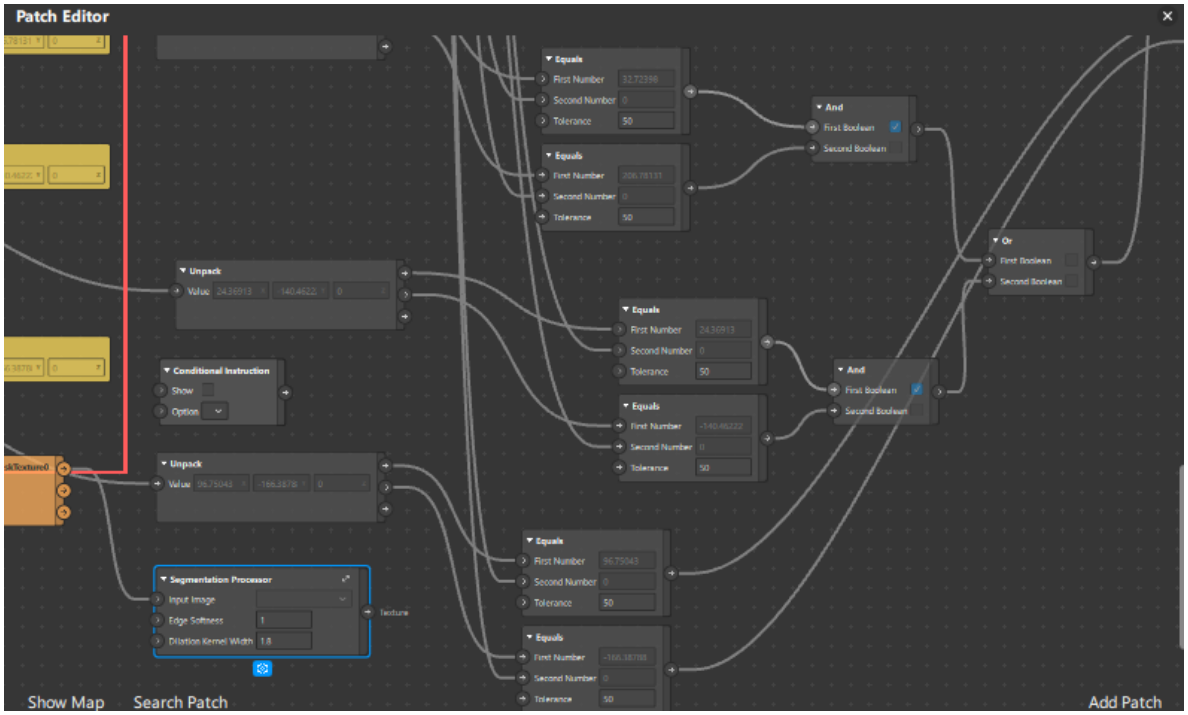

Fig 4.3.6 *Detecting Joins Boolean Function*

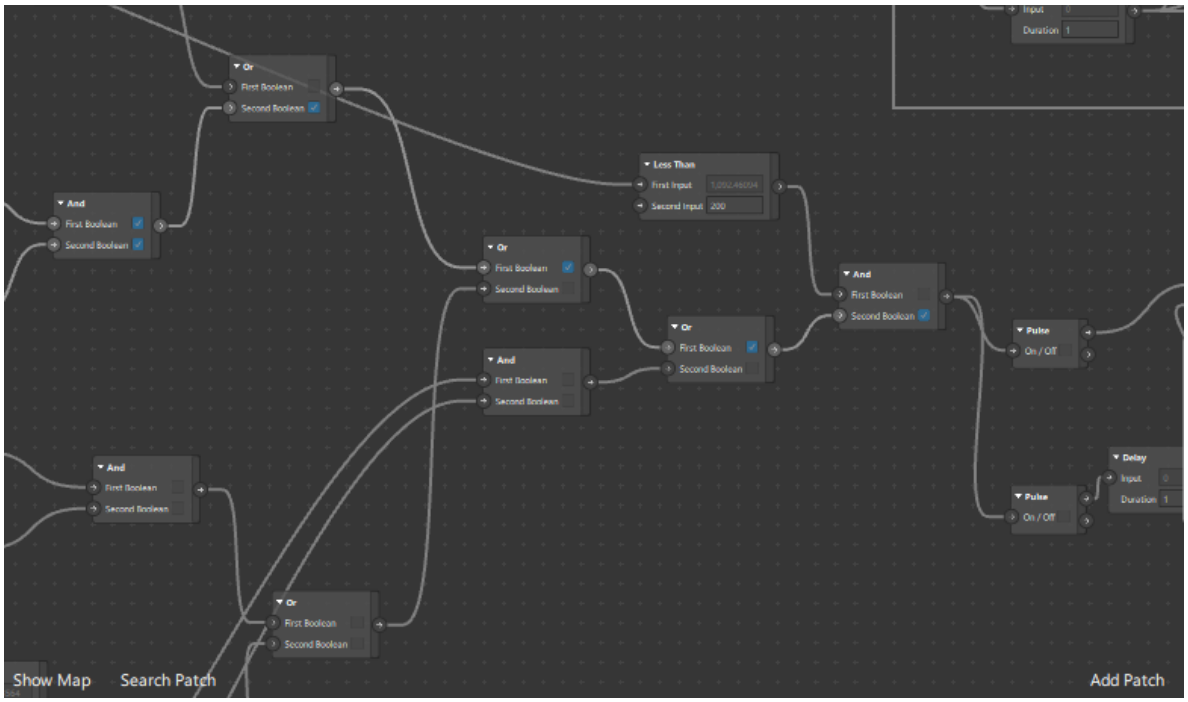

Fig 4.3.7 *Boolean Function making ON&OFF*

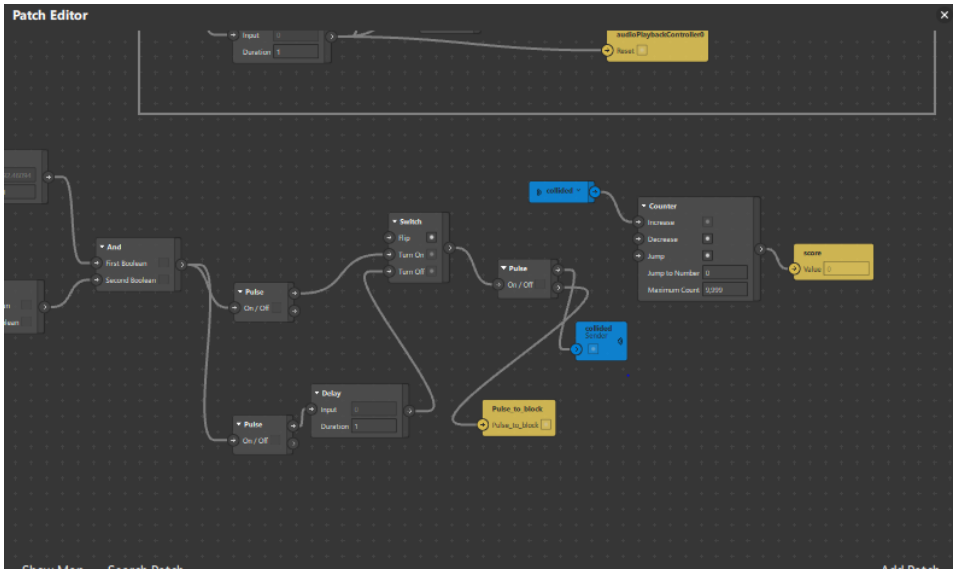

Fig 4.3.8 *Final Collider Boolean Function*

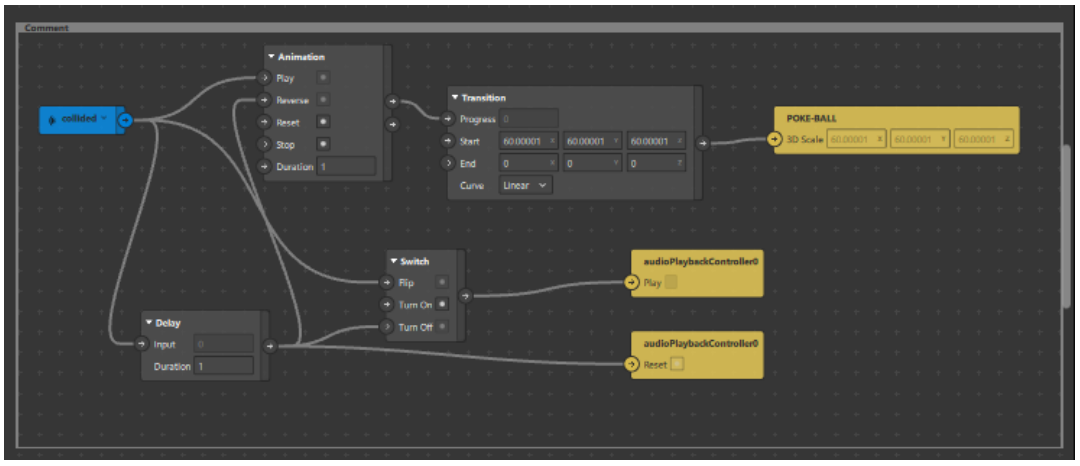

Fig 4.3.9 *Animation Patches for 3D Ball*

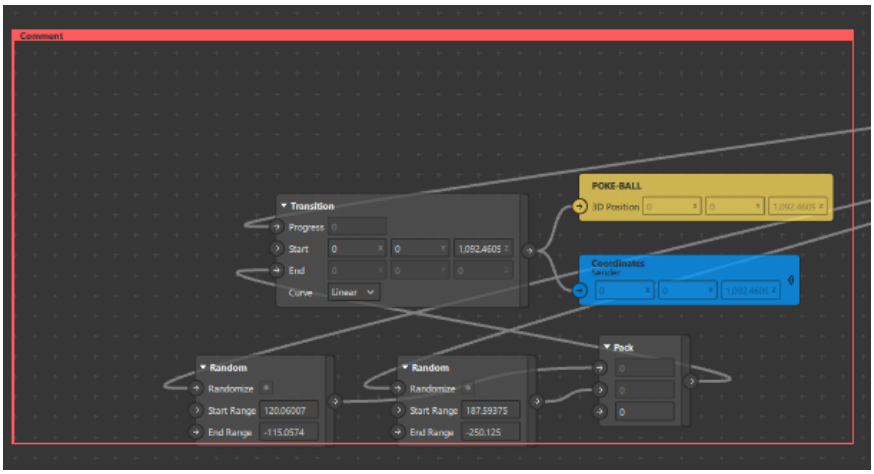

Fig 4.3.9.1 *Animation Transition Patches*

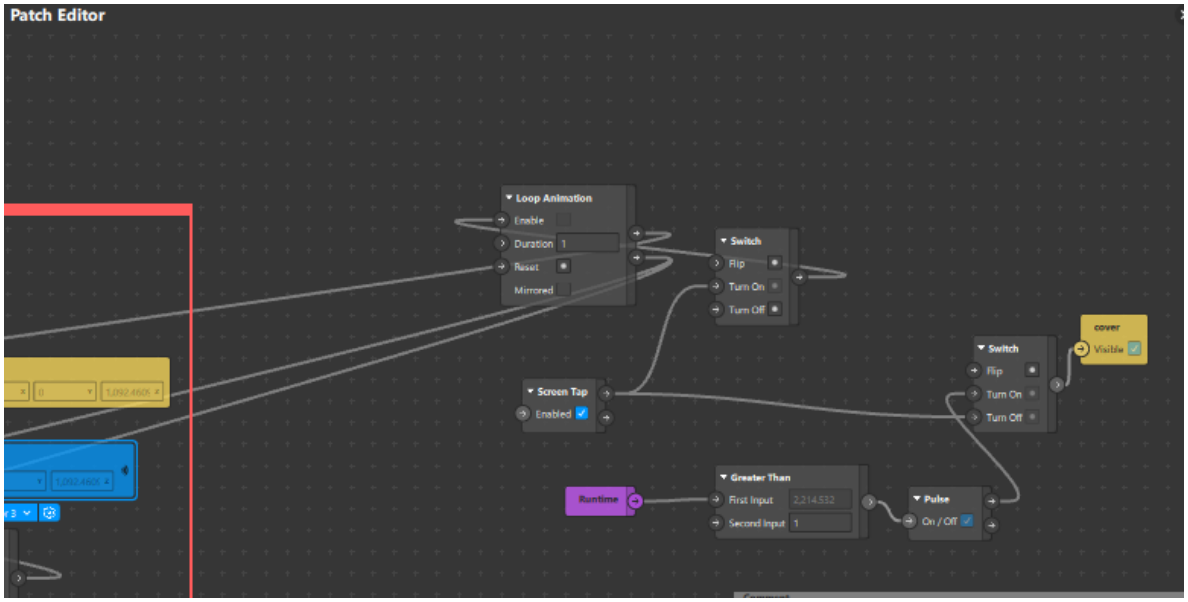

Fig 4.3.9.2 *Loop Animation Patch*

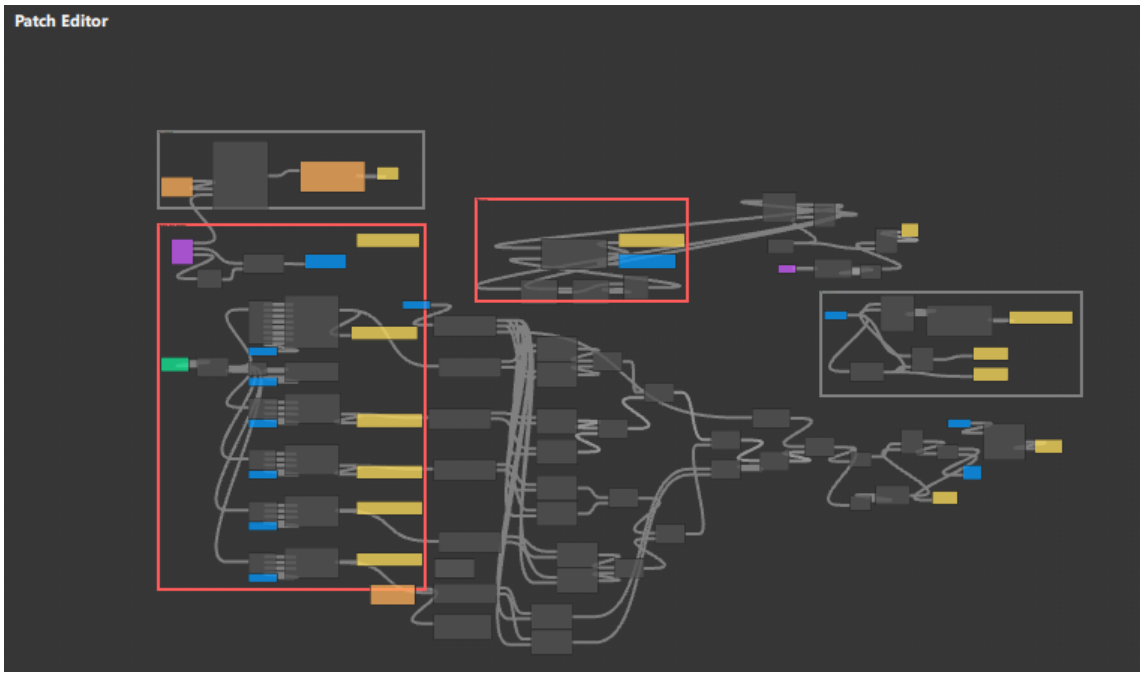

Fig 4.3.9.3 *Patches overview of Body Tracking*

4.3.3 CODE

```
// How to load in modules
const Scene = require('Scene');

// Use export keyword to make a symbol available in scripting debug
console
export const Diagnostics = require('Diagnostics');
const Patches=require('Patches');



(async function () {
  const placeHolder=await Scene.root.findFirst('scorePlaceHolder');
  const score = Patches.outputs.getScalar('score');

  placeHolder.text=(await score).toString();

})(); // Enables async/await in JS [part 2]
```

4.3.4 USER SHARING

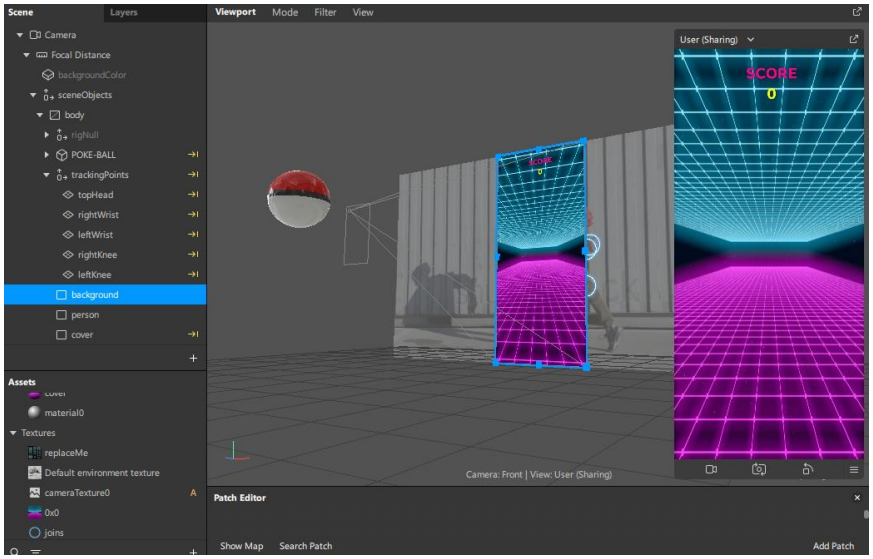

Fig 4.3.9.4 *Body Tracking game Window Panel*

Fig 4.3.9.5 *User Sharing Game Testing*

4.3.5 EXPORTING AND PUBLISHING THE EFFECT

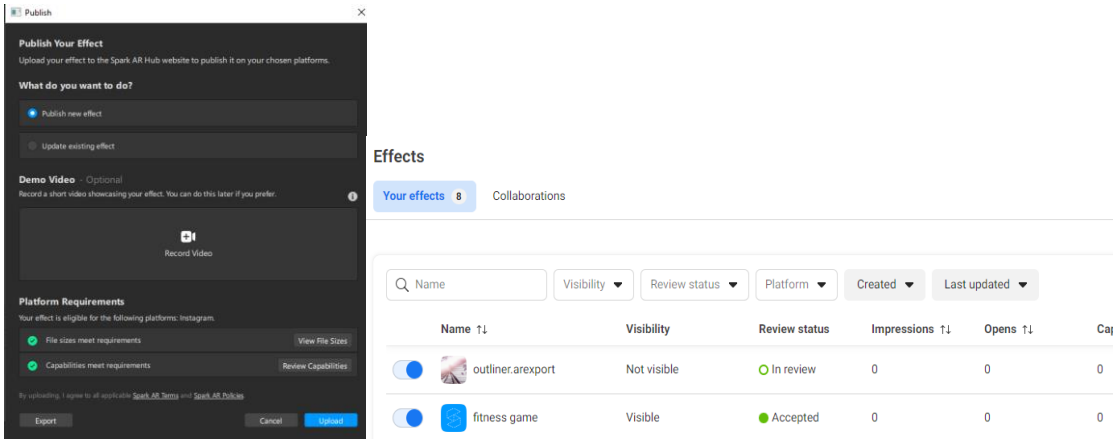

Fig 4.3.9.6 *Body Tracking game uploaded successfully in Spark AR Hub*

4.4-CATEGORY:4 AR Portal (Occlusion Effect)

A portal is by definition a doorway, gate, or other entrance. Those doorways lead to rooms, and those rooms are often surrounded by walls. The walls prevent you from looking into the room. And that is almost how portals work in our case, the AR filter kind.

The most immersive portals, are those that completely surround the user. If someone steps inside an AR portal, they expect to be completely submerged in the new environment. That's why 3D models of rooms and 360 degrees video/pictures work really well as portals. If there's a natural door or gateway in your model you can use as the entrance to your portal, you get bonus points.

4.4.1 UI ELEMENTS

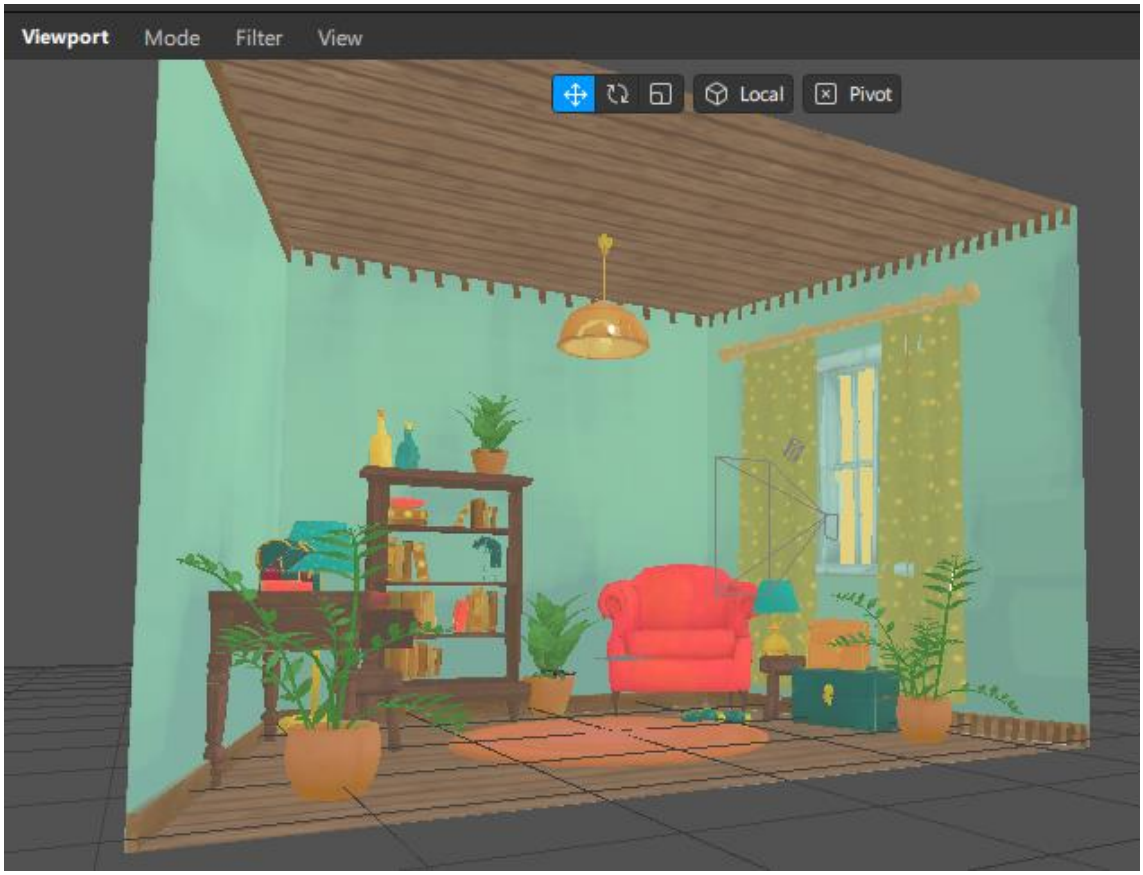

Fig 4.4 *Panorma 3D House 360 view*

Fig 4.4.1 *Door 3D Model for Occlusion*

4.4.2 DEVELOPMENT FRAMEWORK

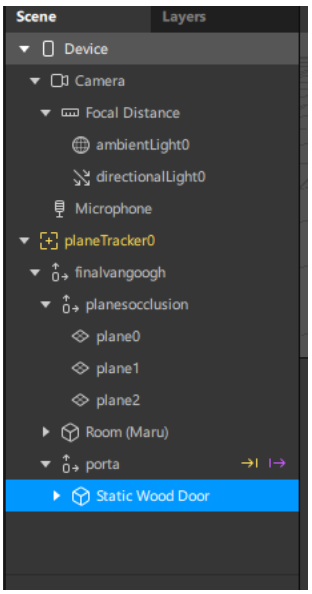

Fig 4.4.2 *Child and Parent Objects for Occlusion AR portal*

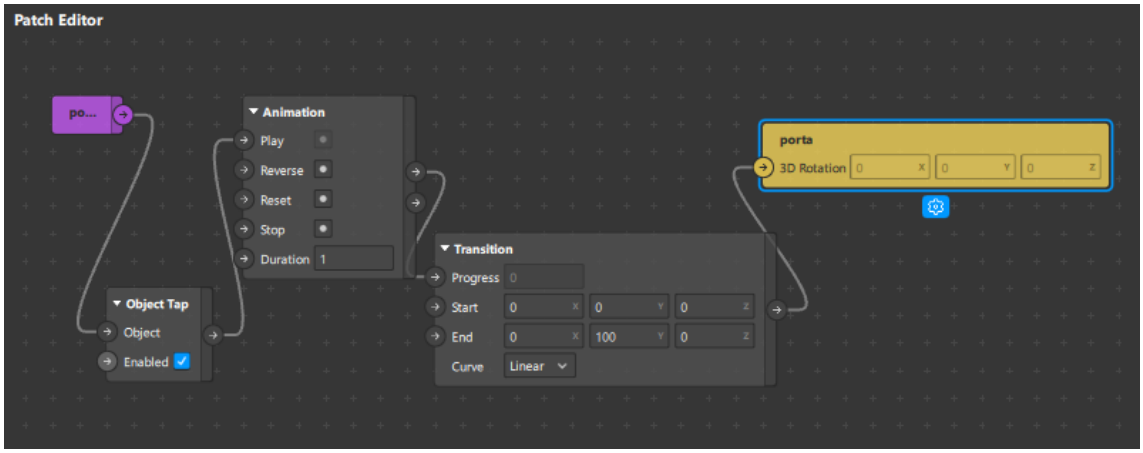

Fig 4.4.3 *Patch Editor for Door Transition*

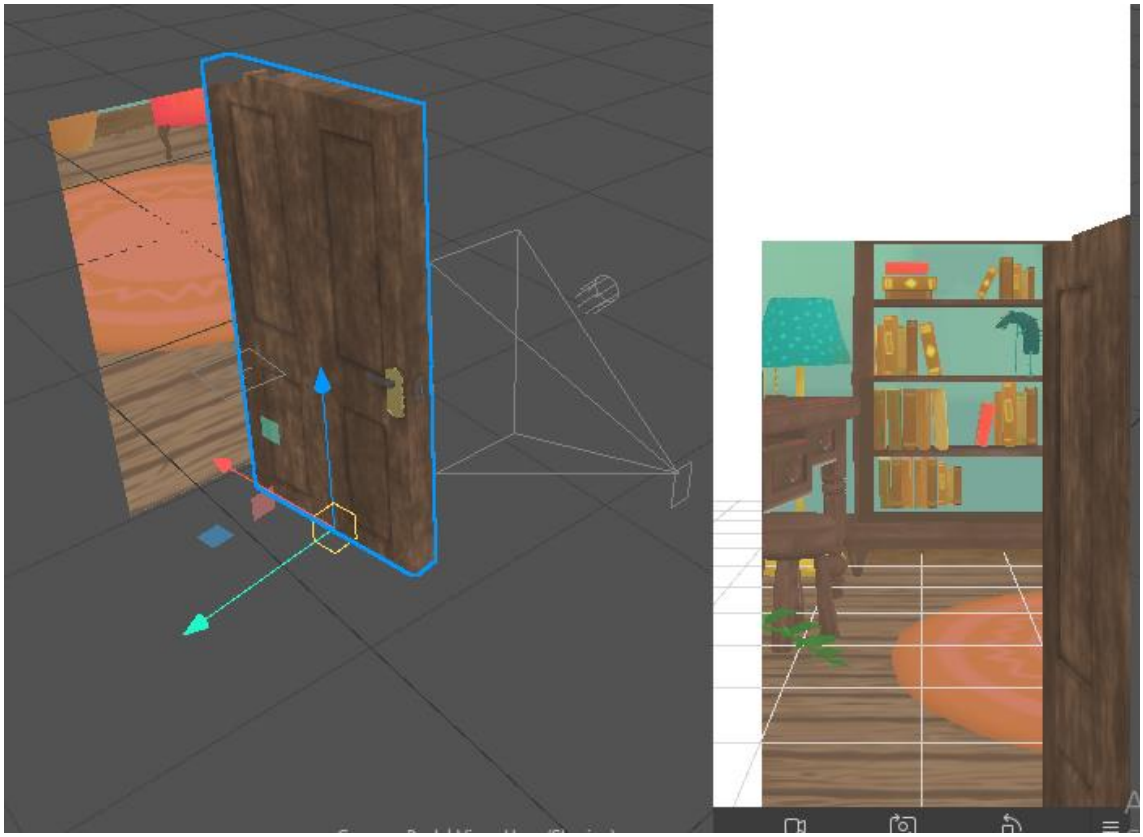

Fig 4.4.4 *Entering into 3D house*

4.5 Category 5- Diaphragm (Medical AR)

AR applications enable medical professionals to recreate real-world images of anatomical structures virtually, an image they can then project onto the surgical site in real-time using the HMD technology.

4.5.1 UI ELEMENTS

In this project, we need 3D model of diaphragm to visualize the elements and its bone structure.

Fig 4.5.1 *Diaphragm 3D Model*

4.5.2 DEVELOPMENT FRAMEWORK

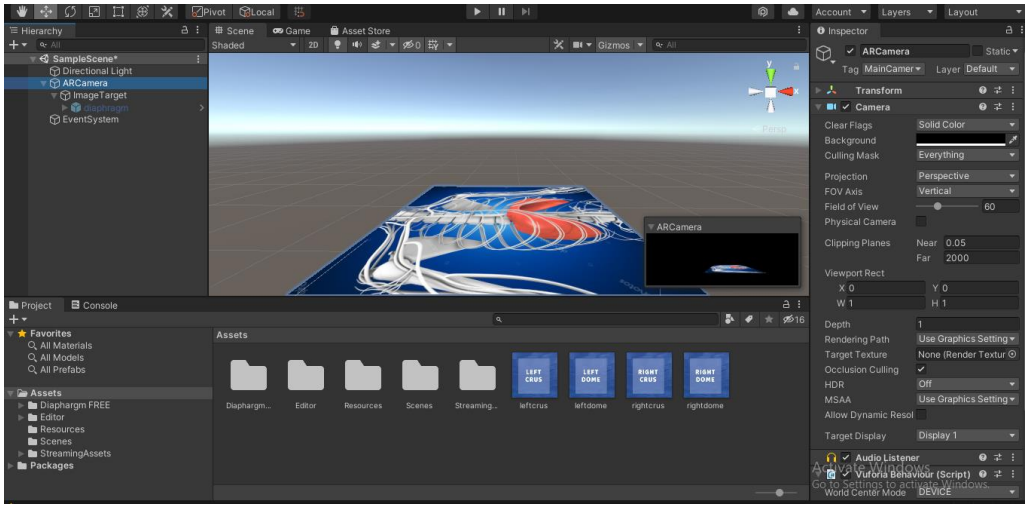

Fig 4.5.2 *AR Camera Properties*

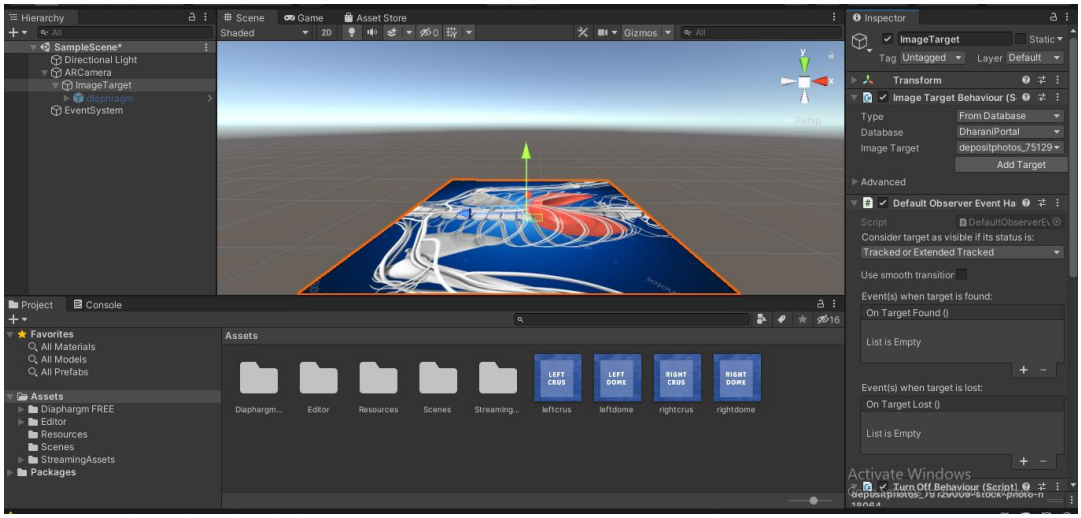

Fig 4.5.3 *Image Target SDK*

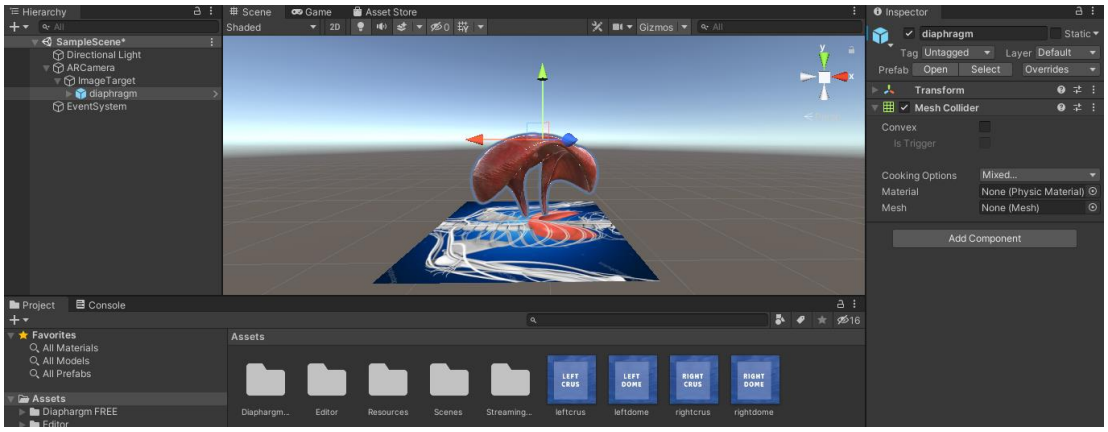

Fig 4.5.4 *Importing 3D Model into Image target*

4.5.3 EXPORTING INTO APK

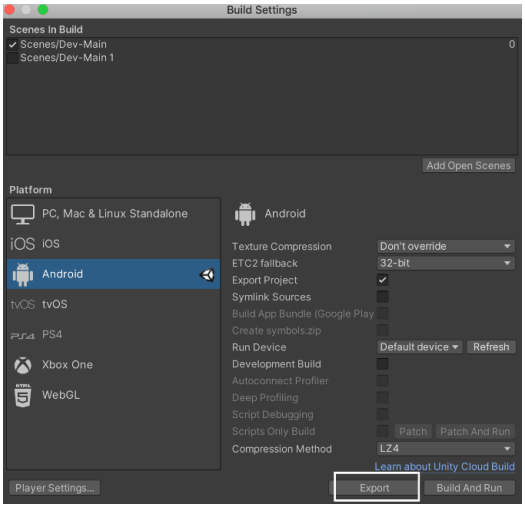

Fig 4.5.5 *Exporting into APK*

5.Testing & Validation

5.1 AR FILTER

Fig 5.1 *Avatar AR Filter*

AR Avatar Filter was successfully exported and running in Instagram Platform

5.2 OUTLINER

Fig 5.2 *Immersive world experience AR Filter*

AR Outlier filter was successfully exported and running in Instagram Platform

5.3 BODY TRACKING GAME

Fig 5.3 *Body tracking game*

AR Body Tracking filter was successfully exported and running in Instagram Platform with animations , joins tracking and audio controller with score adding.

5.4 AR PORTAL – OCCLUSION

Fig 5.4 *Occlusion*

AR Occlusion effect filter was successfully exported and running in Instagram Platform with 360 Panorama view.

5.5 DIAPHRAGM – MEDICAL

Fig 5.5 *Diaphragm in AR*

This medical application was done in Unity Engine irrespective of Spark AR Platform. So, it exported into Apk format and it is successfully running in its AP FORM and detecting the image target with Lean touch,scale,zoom.

CHAPTER 6

Discussion

Augmented reality is an interactive, computer generated reality that recreates your surroundings and adds enhanced computer-generated objects wherever you turn your screen. AR has limitless potential for creating new worlds, scenarios, and situations. One of the first and most widely known AR games was Pokémon Go. Users of the Pokémon Go app were able to live a dream come true as a Pokémon trainer by catching Pokémon in their own towns.

While AR can be used for games it has so many more uses that aren't as widely known. Companies like Ikea and Lowe's have developed their own AR apps which allows users to see if furniture will fit where they want to put it before they buy it. Dulux Visualizer is an app that allows you to test paint colors and how they look in your house without the hassle of comparing thirty different paint chips.

As helpful as those apps are, there are real world benefits to the use of augmented reality technology. Research on how to use AR in the medical field have shown that it would not only help with something like nurses finding veins easier but it would allow surgeons to have a sort of x ray vision that would help them to navigate surgeries with more precision. Likewise, this technology can be used in teaching medical students the anatomy of the body in 3D.

There is one more use for AR that needs to be mentioned. The American military is using AR technology in the goggles of soldiers in order to allow them to see better what is happening on the battlefield and to identify allies from enemies. AR has unlimited potential and can be used in just about any company in some way or another.

AR allows a 3D virtual creation of a company's product which would help them to see any manufacturing flaws that would need to be addressed before it was made and sold. Not only that but it is able to create 3D advertisements on brochures, billboards, flyers, and in the front window of a store. Technology that would allow a company to connect with its clients, face to face, in 3D, is on the brink of being a widely used system.

CHAPTER 7

FOBOM AR Future

In case of AR Filters, It's a gigantic measure of eyeballs searching for connection with content. What's more, research shows that individuals who use AR Filters use them on normal for 75 seconds - 4X longer than portable video.

In case of Games, related to fitness industry. These applications add to a customary games movement in various ways: cooperation with superstar mentors, safe drenching in dynamic gaming conditions, and in particular, gamification of one's wellness schedule. At PhotonLens, they treat gamification pretty seriously

In case of design ,Creating applications that empower organizations to superimpose 3D models into actual spaces will permit them to convey more grounded deals and showcasing material.
occlusion:

In case of occlusion, AR Portal enhances the real estate and estimate the space occupied and interiors how much the value of land with immersive world experience.

In case of medical,AR coordinates computerized data with the client's current circumstance progressively and is turning out to be more available and reasonable for clinical schooling and imaging, dentistry.

This study includes all the different types of Augmented reality that are being used to develop different techniques. It mainly focuses on filters that every new user knowing them ,how to use it , it makes more and more advancable as it enhancing the every experience that needs to be followed.

CHAPTER 8

Conclusion

This study includes all the different types of Augmented reality that are being used to develop different techniques. It mainly focuses on filters that every new user knowing them ,how to use it , it makes more and more advanceable as it enhancing the every experience that needs to be followed.

Every field i.e., related to Augmented reality is discussed in this project ,the ease of access to AR is very simple these days compared to previous century. In 21st century every user has the access to Instagram. So, publishing these filters into Instagram makes it easy to everyone who wants to experience this AR.

However, greater AR integration is needed in collegiate combat sports. All software ,hardware , future opportunities related to FOBOM are discussed in the project.

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