



**FINAL YEAR PROJECT REPORT**  
**REALVIEW: AR/VR FOR REAL ESTATE COMPANY**

**BY**

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This Report Presented in Partial Fulfillment of the Requirements for the  
Degree of Bachelor of Science in Multimedia and Creative Technology

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**DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA, BANGLADESH**

**MAY 2019**



## APPROVAL

This Project titled “**Realview: AR/VR for real estate company**”, submitted by Md. Abdullah Al-Mamun to the Department of Multimedia and Creative Technology, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Multimedia and Creative Technology and approved as to its style and contents. The presentation has been held on **15 May, 2019**.

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## DECLARATION

I hereby declare that, this project has been done by me under the supervision of Dr. Shaikh Muhammad Allayear, Associate Professor and Head, Department of MCT Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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I would like to thank my senior brothers in Daffodil International University who took part in this discussion and helped me and supported me on this project while completing the coursework

Finally, I must acknowledge with due respect the constant support and patience of my parents.



## ABSTRACT

Augmented reality (AR) is the overlaying of digitally-created content such as computer-generated graphics, videos, texts and sounds are layered on top of a physical view. Augmented reality permits the users to have interaction with real and virtual elements or augmentation. Whereas Virtual reality (VR) is computer generated stereo visuals which replace the actual world surroundings of a consumer around them. Both Augmented and Virtual reality may be supplied to consumers through headsets like HTC Vive, Oculus Rift, and Microsoft's HoloLens or through the camera of a mobile phone. In both practical and experimental implementations, augmented reality and virtual reality can replace or lessen the consumer's belief of truth.

Augmented and Virtual reality has been adopted in various industries such as retail, healthcare, science educational and real estate. Some agencies accept already fabricated use of this avant-garde technology in several ways, from auspicious their book catalogs to alternate demonstrations at accession and on an adaptable screen. That is why I choose augmented reality and virtual reality in real estate visualization to give the clients more informative and visual proposal and for the agencies who touch upon buyers that have a clearer vision on an attainable deal.

I start Realview: AR for Real estate from the AutoCAD master plan layout, complete the model using by AutoCAD, 3Ds Max, Adobe Photoshop plays a role texturing whole project and Unity game engine for Virtual reality and Augmented reality. In this project, we can discover an outline architectural visualization of actual estate buildings that customers are shopping for with the view of what they're buying, in augmented and virtual reality.



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

The first ever Augmented reality app was created in 1968 by father of computer graphics “Ivan Sutherland” [1]. It turned into an AR head-installed display gadget. From then on AR superior as wearables and digital shows. It could format virtual factors at the actual-international photo, as an instance, show geological information approximately about a selected area. In the year 2008, Augmented reality has opened a way of using augmented reality in industrial purpose. A Garman agency developed an augmented reality application for BMW Mini. To enable it a customer had to point a camera at a printed ad and the model of car auto come alive at the display. The customer could manipulate car on the screen by controlling it and move it around to view at different angles, simply by manipulating the printed image.

In the early 2010s Augmented reality introduced that might have interaction with actions in the real world in real time. For that reason, the virtual try on technology has all started by augmented reality’s instant face recognition revolutionized buying experience. Now you can try out anything form virtual making up your face to place a couch inside your home.

In 2016, augmented reality (AR) catapulted into the mainstream with the release of Pokemon Go [2], an AR game that grew to 45 million daily active users after just two months on the market. Since then AR has been adopted in various industries.

Let’s take a look at what augmented reality is, the benefits of augmented reality.

Augmented reality [3] can be described in somewhere between physical world and virtual world where computer generated images, texts, sounds, animations, videos are layered on the top of the physical view. Users can interact with these elements via



application on smartphones, tablets, augmented reality headsets like Microsoft HoloLens [4], and augmented reality glasses like Vuzix Blade [5].

### **Benefits of Augmented Reality:**

One of the significant benefits of augmented reality is it can visualize information in 3D rather than 2D. As an Example, for an architecture planning, drawings and renderings are usually presented in a flat and 2D format, However, with Augmented reality those viewing plans can be shown as 3D format where walking around the model, look at every angle of the future building can build its own opinions about its design.

Another important benefit of augmented reality is it can not only make complex data easier to understand but also create an interactive experience that is intuitive, meaningful and also memorable to the users.

In addition, augmented reality can create personalized product experience, generating buzz, establishing repeat engagements of customers. Think about giving trials of cloths without even putting them on or furnishing interior with furniture's without moving or buying them. Also, we can look into Pepsi bus shelter advertisement [6], for using augmented reality in real life.

### **Benefits of Virtual Reality:**

Virtual reality (VR) [7] is an interactive computer-generated revel in taking place inside simulated surroundings. It contains particularly auditory and visible comments, but might also allow different kinds of sensory remarks. These immersive surroundings can be just like the actual global or it is able to be fantastical. present day VR technology maximum typically uses virtual fact headsets or multi-projected environments, from time to time in aggregate with physical environments or props, to generate realistic snap shots, sounds and different sensations that simulate a consumer's physical presence in a virtual or imaginary environment. a person the usage of digital reality gadget is able to "look around" the artificial international, flow around in it, and have interaction with virtual functions or gadgets. The impact is normally created through VR headsets along with a head-mounted show with a small display in front of the eyes, but can also be created via mainly designed rooms with a



couple of huge monitors. other styles of VR encompass augmented truth and mixed reality structures.

Generally, an actual property agent gives a long listing of residences to the customer. later on, come the explanations, negotiations, and ultimately the actual-existence visits to homes and residences. This workflow has remained the equal for decades, but in fact it's inconvenient and time-eating no longer only for realtors however for homebuyers as properly.

## **1.2 Motivation**

According to various studies, Augmented Reality (AR) and Virtual Reality (VR) in real estates makes customes interested and involved. In general, Augmented Reality (AR) and Virtual Reality (VR) is quite fasciniting and enchanting. Augmented and Virtual Reality visualization works much better than photos and videos with text description.

Most of the clients who wants to buy real estate properties, before they make the final decision of purchase wants to visit the apartments by themselves. Augmented and Virtual reality may lower the numbers of the visits and can save time from clients and developers.

I would like to create a Augmented and Virtual reality application for mobile devices by which Real estates developers or sellers can show a virtual tour of the apartments they are selling to the clients. I wanted to create an application that consists 3 different type of bulidings with Exterior and Interior views of the apartments in the building. Different types of softweres will be used to create the whole project.

For modeling the buildings I have used :- Autodesk 3ds Max [8].

For Texturing the buildings I have used :- Adobe Photoshop [9].

For Creating Augmented and Virtual reality Application I have used :- Unity3d [10].

The final Output will be a complete application with 3 buldings Along with their Exterior and Interior views. Users can scale and rotate the buidings as they want and they will also have First Person View to have a walkthrough inside the apartments if they doesn't have any Virtual Reality device.



By completing this project, it will give me more opportunity to show and share what I have learned till now as a student of Multimedia & Creative Technology department of Daffodil International University. This will improve my confidence and skills for the job market as well.

### **1.3 Objectives**

The objectives of the project are to:

Make the AutoCAD [11] drawing plans into a 3D architectural visualization.

Develop 3D models of the AutoCAD plans with Exterior and Interior views.

Texturing the models to give a better look.

Making “Realview: AR for real estates” an application with Augmented Reality and Virtual Reality along with First person view.

Getting a better output for my final project.

The following chapter presents the research of the project including various important information about the project. The methodology of the development of 3D models. This chapter includes the plans I have been working with to complete the project. Explanation of Augmented and Virtual reality works is presented in chapter 4. The developing software's and plugins are discussed with reference in chapter 5. The problems that solved based on user experience are discussed in chapter 6. The outcomes and technology uses are discussed in chapter 7. Finally, an overview with the conclusion and further works is given in chapter 8 and 9.



## CHAPTER 2

### RESEARCH

First of all, I will give thanks to my seniors that they have built an Augmented and Virtual reality project on the architecture plan of DAFFODIL INTERNATIONAL UNIVERSITY of 2040. I was lucky to have the chance to watch closely the project they have accomplished. When they were building their project, I had an idea of visualizing the AutoCAD maps in a different and more effective. I had learned Augmented and Virtual reality developing from a Workshop that was organized by our department. I learned how to develop augmented and virtual reality projects on that workshop. But I had very limited idea on developing augmented reality and virtual reality applications. So, When I had the idea of making an application for Real estate developers, I had to do research about how am I going to accomplish this application. I discussed my idea with my supervisor and senior students of my department. They have helped me with my research and finding solutions for the obstacles I will be facing.

So, before I jump into my creation process, I tried to understand the requirements I need to fulfill and how am I should be doing that. I wanted to manage a list of software's and technical needs which are required to build this product.

Here's the list I have made:

- Models
  - Full building exterior
  - Interior for Level One
- Augmented Reality (AR)
  - Single Tracking
  - Multi Models
- Virtual Reality (VR)
  - 3D Walkthroughs



Initially I had the idea of making the features only for augmented and virtual reality view. But sometime later while I was discussing the project plan with my supervisor, he asked me about what if any user has no Virtual reality device and what if user has lost the tracking the image or the wrong tracking image even worse, he doesn't have the tracking image? I got stuck and realized yeah what will happen then? Then I re-oriented the project plan and made the project plan given below:

- Models
  - Full building exterior
  - Interior
- Augmented Reality (AR)
  - Multi Tracking
  - Multi Models
- Virtual Reality (VR)
  - 3D Walkthroughs
- First Person View (FPS)
  - 3D Walkthroughs
- Normal Unity View (Non-AR mode)

## 2.1 Models

**Full building exterior:** Develop building models in low-poly but with realistic view. This help to properly visualized the beauty of that building.

**Interior:** By creating interior design it gives that clear vision how arrange the furniture. Those are made by lightweight technology.

## 2.2 Augmented Reality (AR)

**Multi tracking:** Single app for all buildings. Click and scan on your desire building and see the magic of AR/VR.

**Multi models:** By scanning a single tracker system will bring 2 models. Which are

1. Full building
2. Interior





## **2.3 Virtual Reality (VR)**

**3D Walkthrough:** In VR mode use can freely move around the floor. It will give him/her the real flavor of being inside that floor.

## **2.4 First Person View (FPS)**

**3D Walkthrough:** In FPS mode use can freely move around the floor. It will give him/her the real flavor of being inside that floor.

## **2.5 Normal Unity View (Non-AR mode)**

If any user doesn't have Image Tracker and Virtual reality device then he/she can go by the normal unity view mode to see the models.

## CHAPTER 3

### 3D MODEL DEVELOPMENT

#### 3.1 Introduction

AutoCAD drawing files are obtained from a Real estate developer company. The company have also provided the elevation of the buildings as a reference to get clear idea of how the buildings would look like. I have to do Research about how will I optimize the buildings for mobile platform. By those researches I have found a way that will render my buildings in mobile platform very easily and smoothly in Augmented reality and virtual reality.

#### 3.2 Layout

The Visual Layout apparatus unites detailing components so they can be organized on a page and yield in a report by means of the Render device. The Visual Layout instrument support non-gathered components as it were. Utilize the Visual Layout device to choose a report type, mastermind report components on the page, and imagine how the report will look. The Visual Layout instrument acknowledges numerous sources of info, gives a review of report components, offers different yield types and page sizes, and takes into account both a flat and vertical layout.

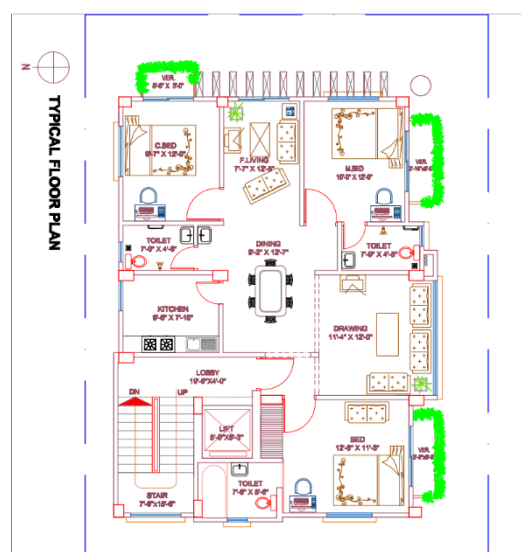


Figure 1: This is a reference AutoCAD building layout

## Importance of Layout

Define the parameters of a model within available resources and time.

Focus and organize each of model.

Great visual layout likewise clearly makes applications more alluring and externally satisfying.

### 3.3 Layouts of my project

I have pre-visualized our final project and drawn the following layout so that the model measurement can act as a reference in AR and VR. To get those layout I looked online for resources and found some Bangladeshi developer companies layout. Then I contact with Rajbari Holdings [12]. They have given me 3 of their layout to work with and then I started working with the AutoCAD layouts.

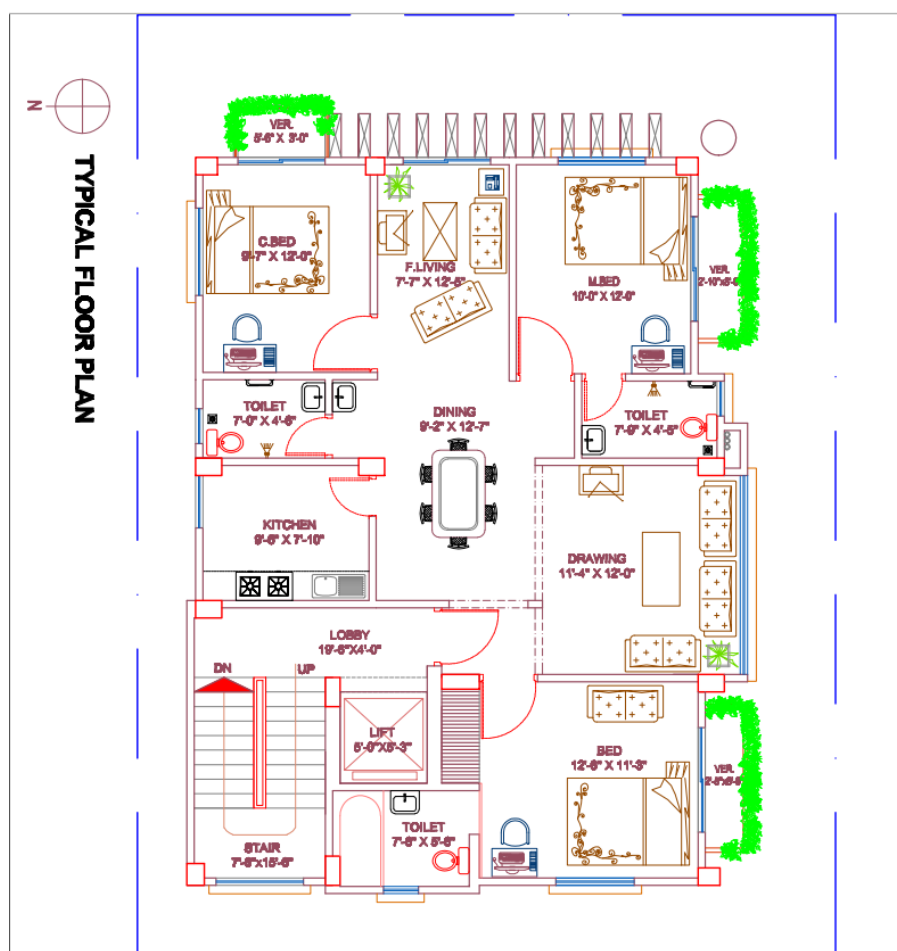


Figure 2: This is 1<sup>st</sup> reference AutoCAD building layout

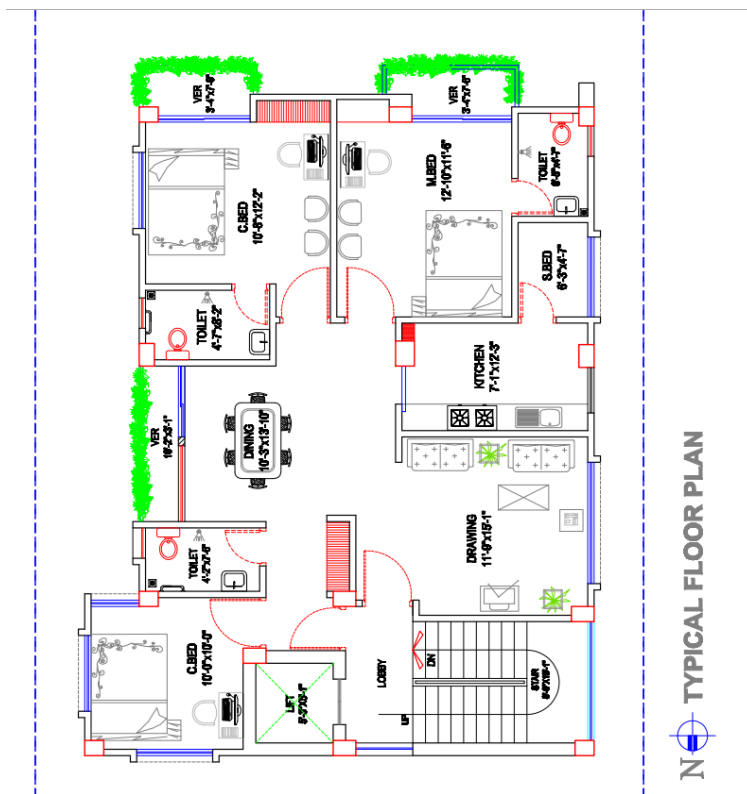


Figure 3: This is 2<sup>nd</sup> reference AutoCAD building layout

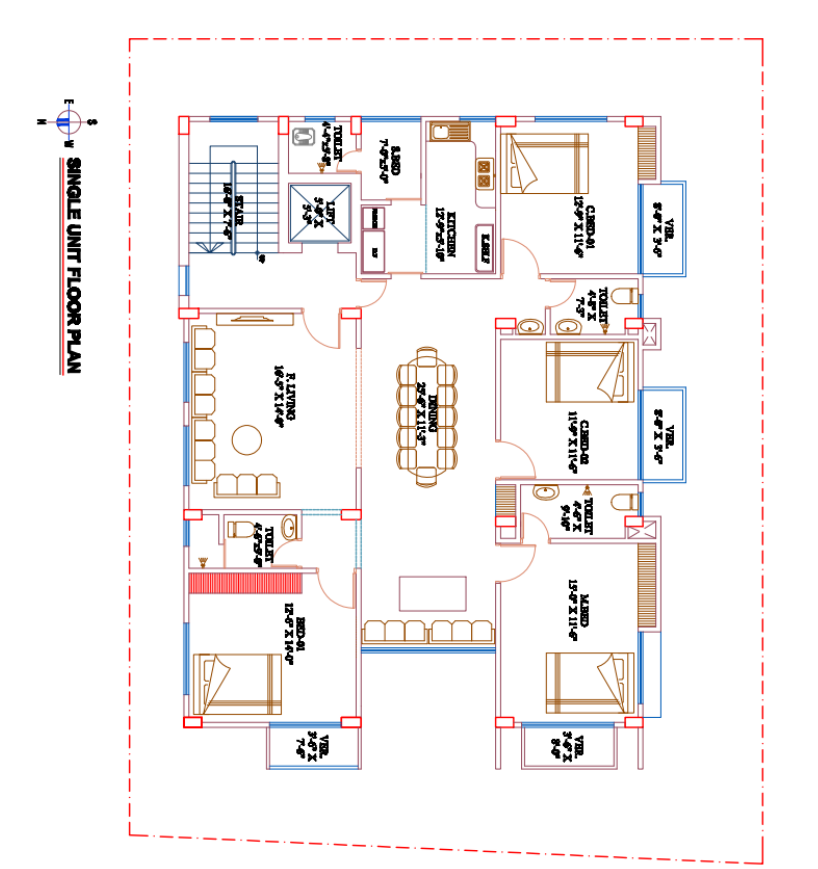


Figure 4: This is 3<sup>rd</sup> reference AutoCAD building layout



## CHAPTER 4

### Workflow

#### 4.1 Modelling workflow

Model processing: 3D model to Autodesk3Ds Max software then imported file from AutoCAD file. Select line from splines to draw line. Then convert the line into editable poly. Then select the faces and extrude the face maintaining the height 10feet.

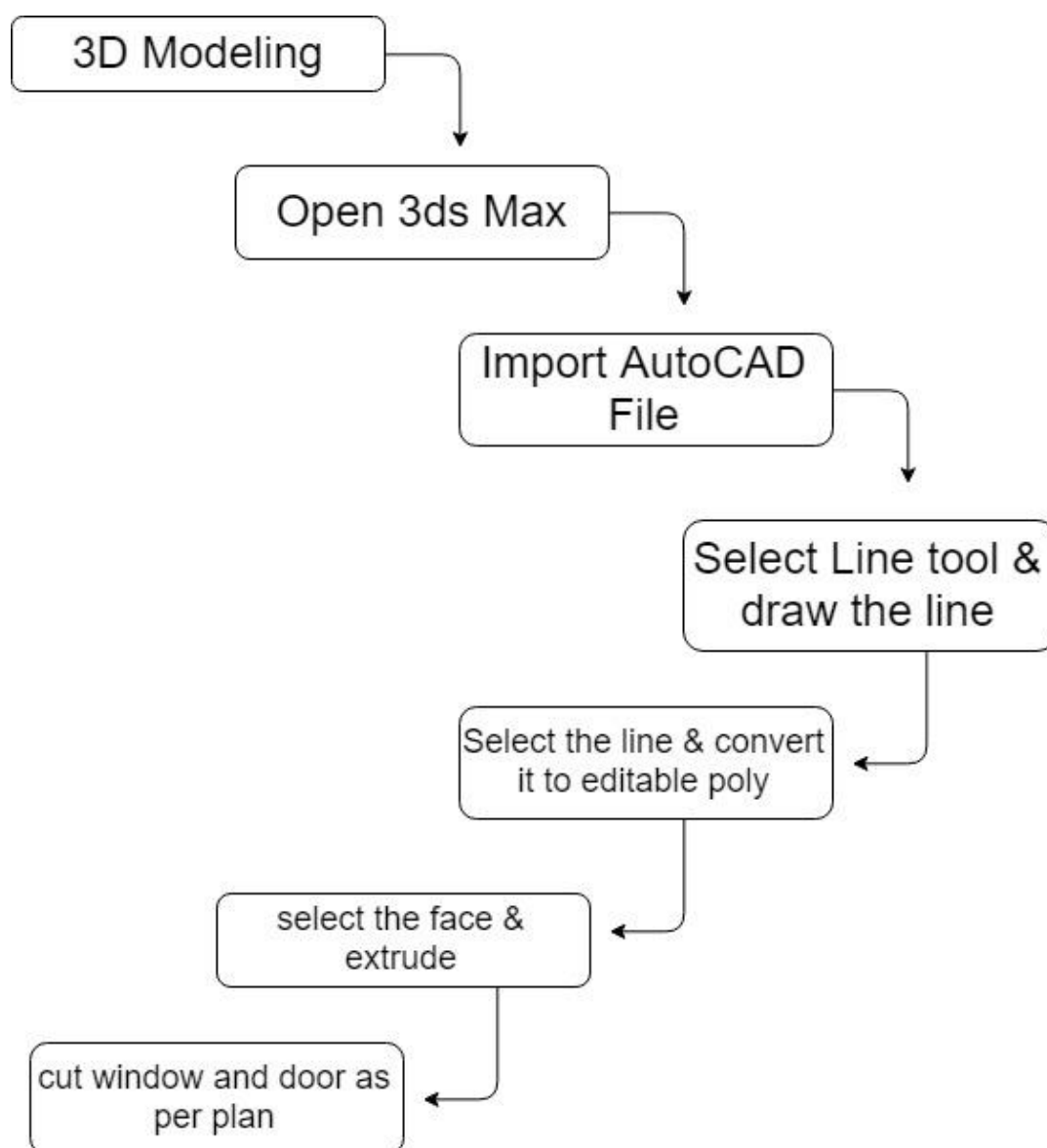


Figure 5: This is the workflow of modeling.

Then, select the faces and cut out the window and door space according to the AutoCAD plan. Then Change standard primitives to doors and select a door for making the doors. I have used Pivot door and sliding door. Then place the doors according to the plan in the 3d model. Same goes for windows.

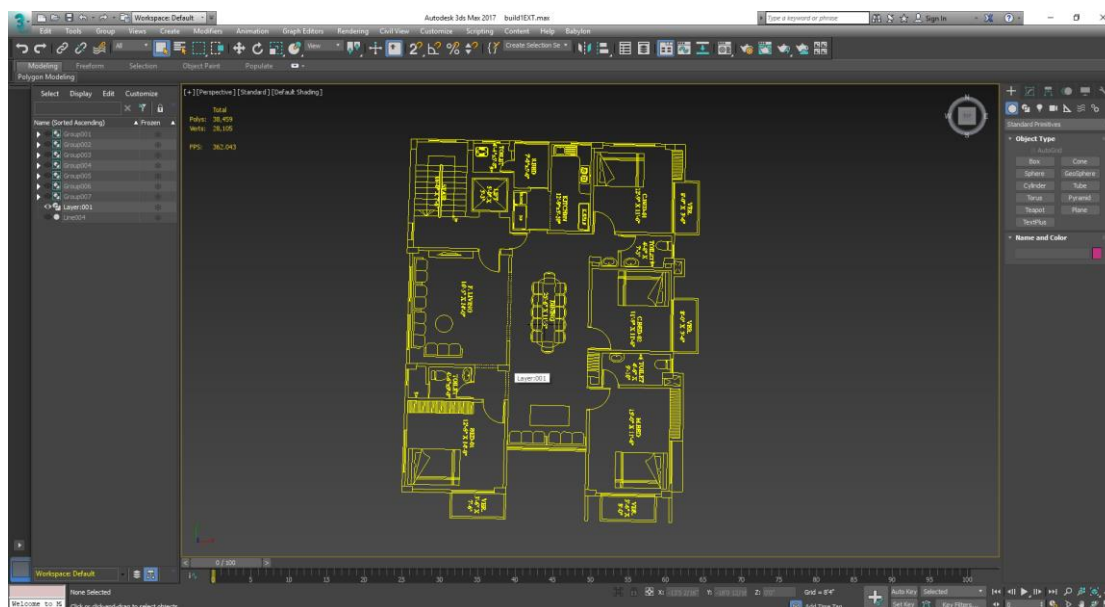


Figure 6 : Imported AutoCAD model in 3ds max.

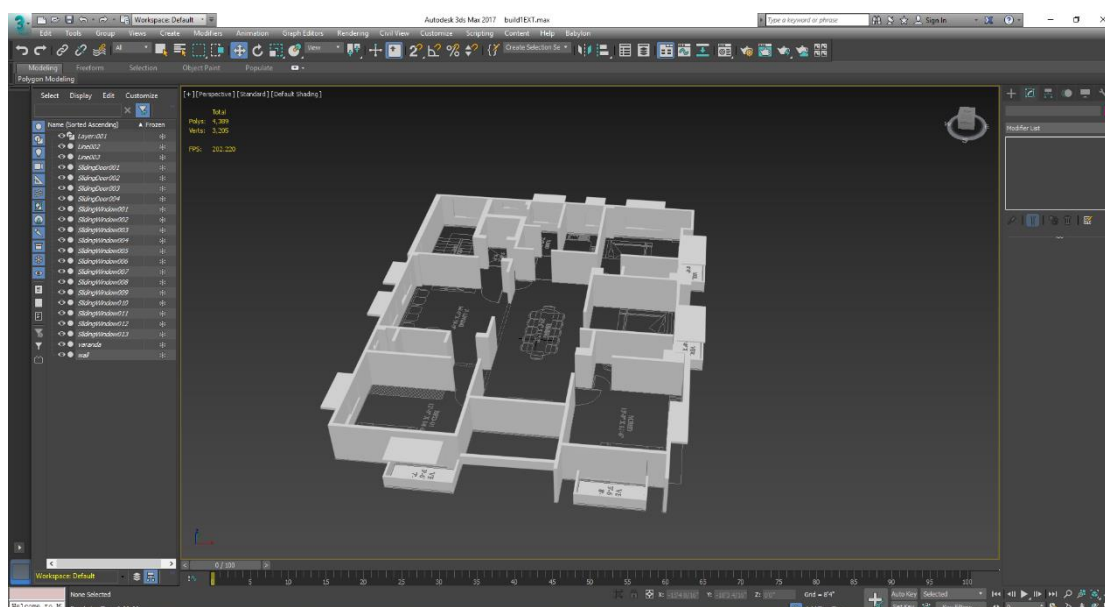


Figure 7: Extruded walls from the AutoCAD plan

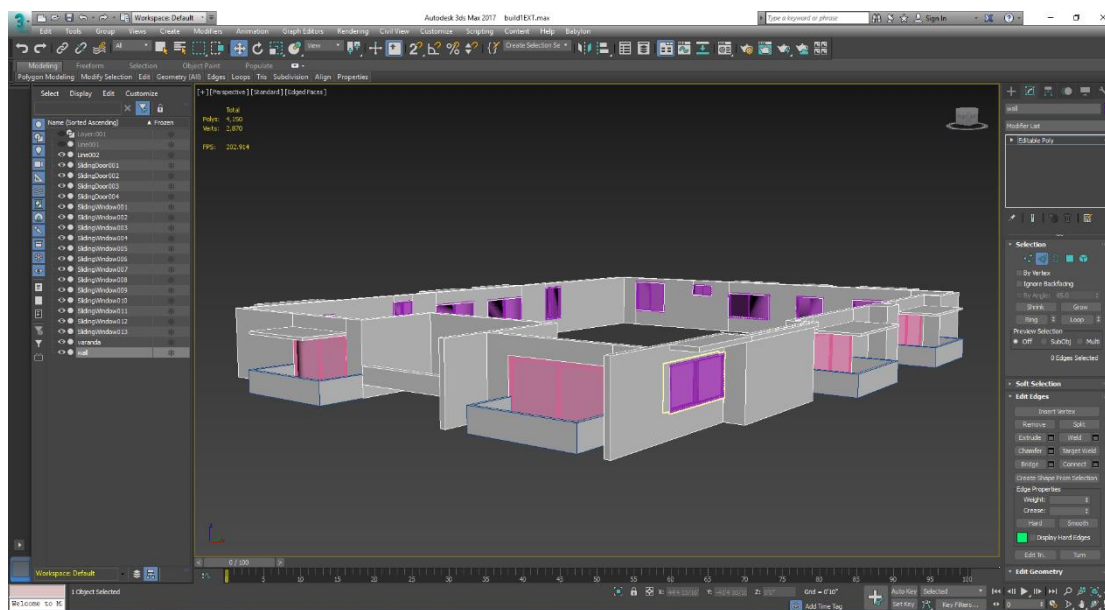


Figure 8:Placing windows and doors in 3ds max

## 4.2 Texturing workflow

Open Material Editor or press CTRL + M (Shortcut key). Change the material mode to compact Material mode. Select a Material slate and double click on its diffuse, click bitmap to insert an image as a texture map. I have used wooden textures for room floor, tiles for kitchen and bathroom floor. I have used multi/sub-object material system for the floor texturing. To do this, I pick another material slate and changed its mode to standard to multi/sub-object material mode. Then I set the ID's I needed. I picked each material to each id. Then I assigned the material to the floors. I have selected each floor and assign material ids to each to get the right material I have set for them. After that I have used UVW map modifier to each object to set the texture right.

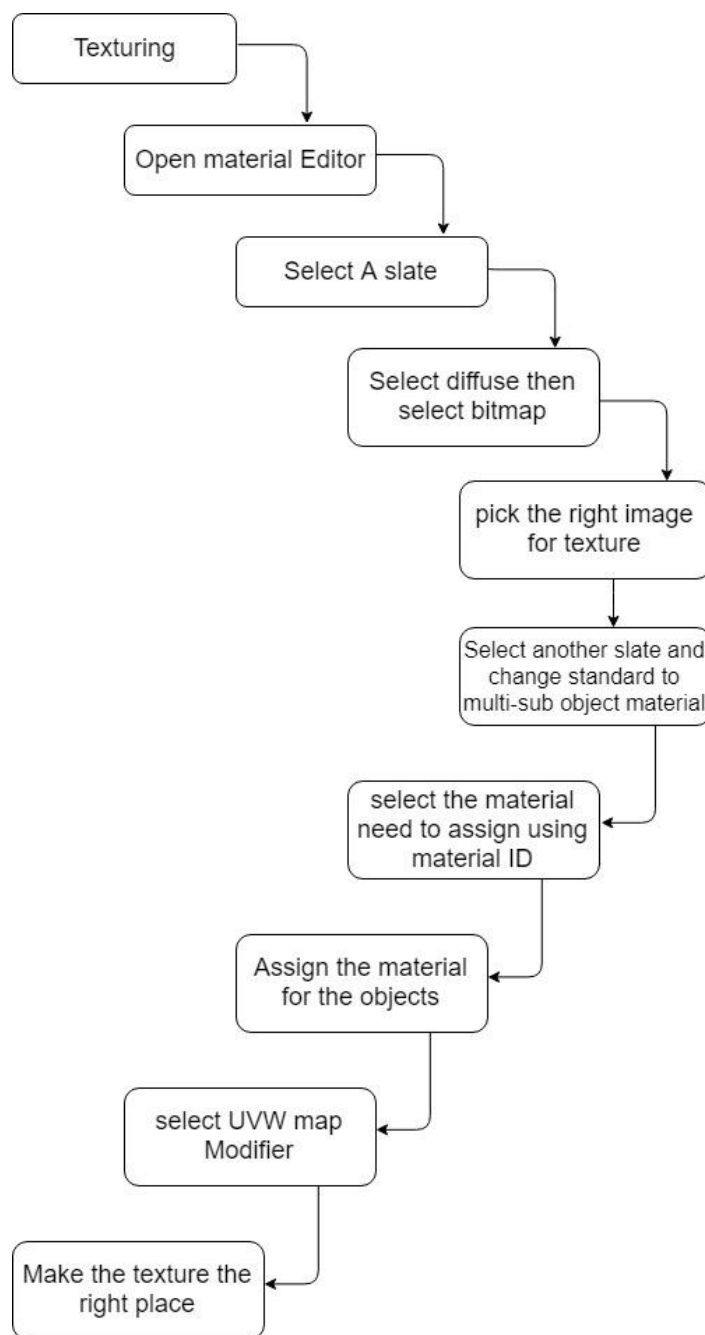


Figure 9: This is the workflow of texturing.



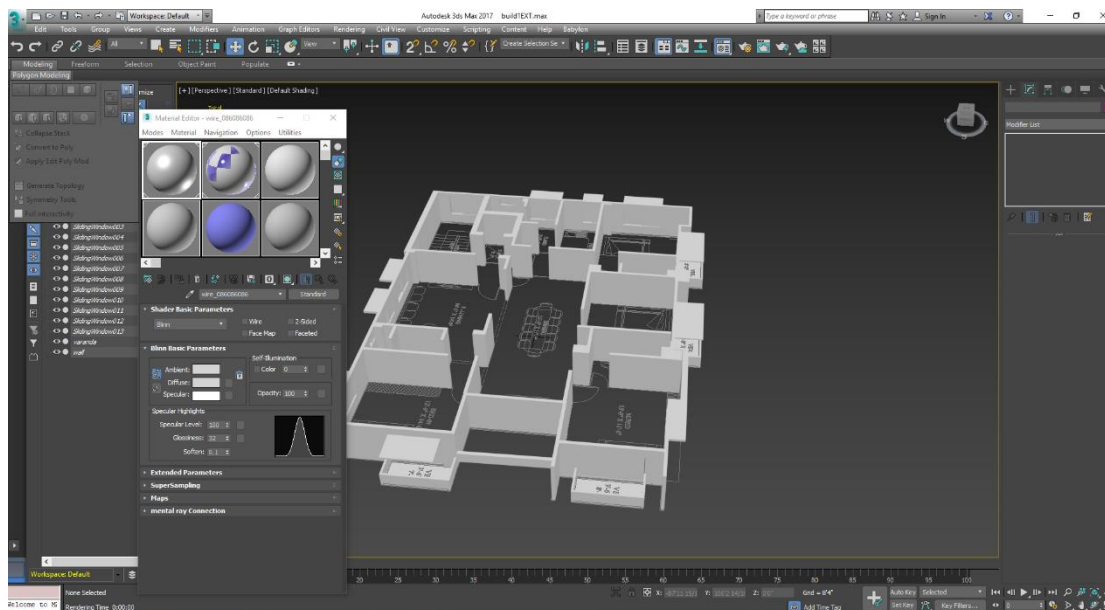


Figure 10: Assigning material to the objects

After assigning the materials I have multiplied the floors to create the full exterior building. I have grouped all the objects then multiplied it.

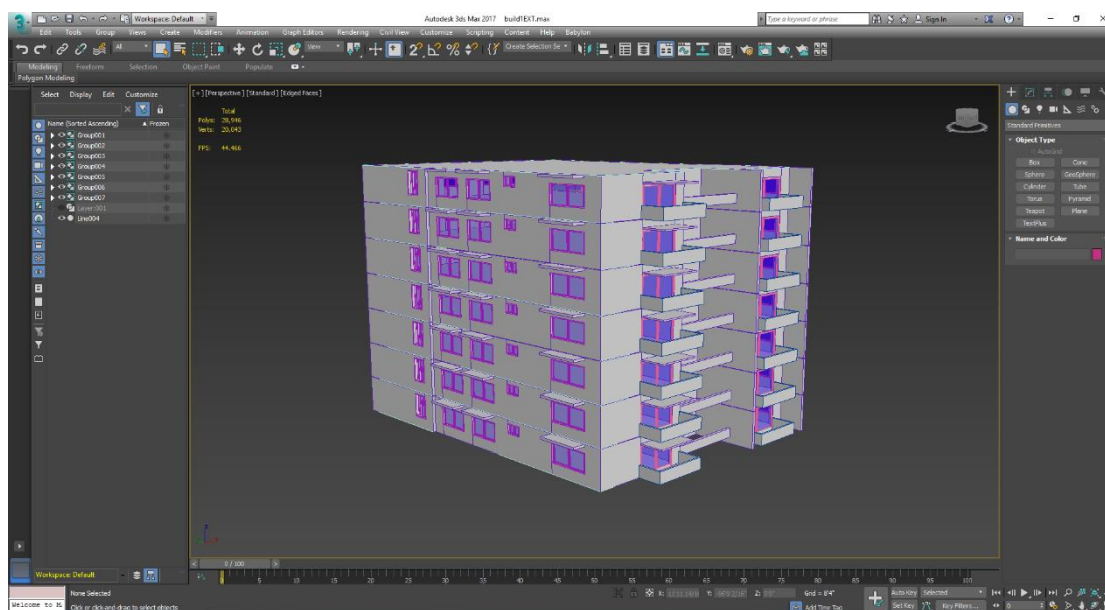


Figure 11: The full exterior building

## 4.3 Exporting from 3ds Max to Unity

To Export from 3ds max to Unity the traditional format of doing Exporting is using FBX format that contains all the meshes and textures and camera, lights etc. But for this project I have used another way of exporting method that will reduce the model size and it will import the models into unity in JSON (JavaScript object Notation) format. To Export from 3Ds max I have used an open source plugin called as Babylon JS [5]. In Babylon js I have selected the models I want to export and then I exported the models.

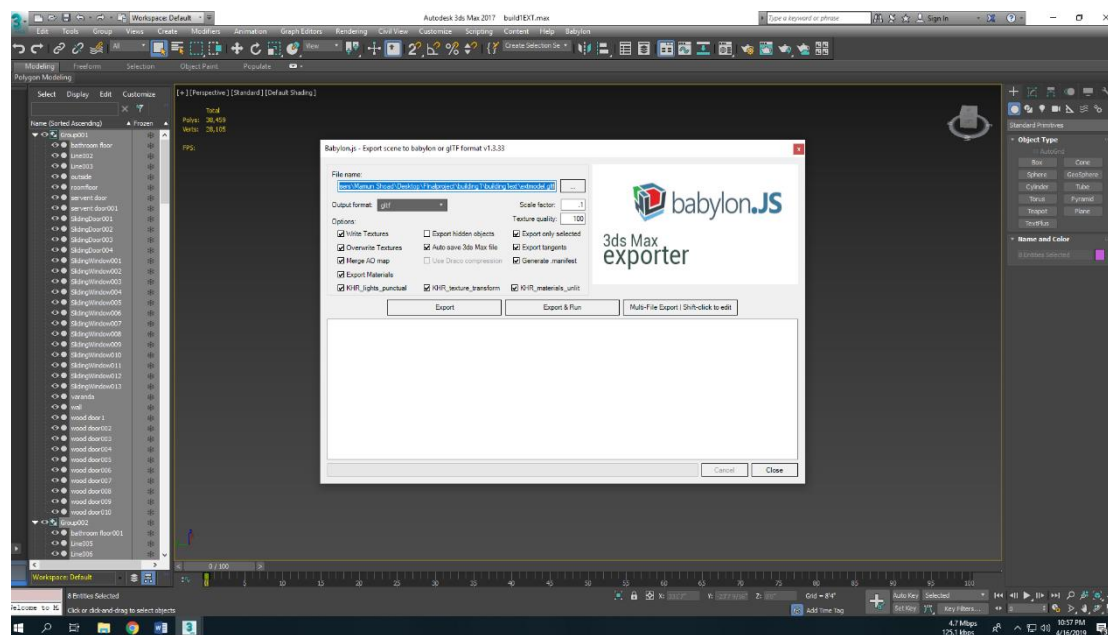


Figure 12: Exporting from 3ds max using Babylon.js



## 4.4 Unity workflow

To start working in Unity3D, firstly I need to make unity capable of making Augmented and Virtual reality. So, after starting a new project in unity, first of all I opened build settings from files.

Table 1: Unity workflow

<b>Unity workflow</b>
<b>Open Unity</b>
↓
<b>Open build settings</b>
↓
<b>Set the platform to Android to Pc, mac &amp; Linux standalone</b>
↓
<b>Open player settings</b>
↓
<b>Go to Resolution &amp; Presentation</b>
↓
<b>Change the orientation to Landscape Left</b>
↓
<b>Go to Other Settings</b>
↓
<b>Change the package name &amp; Set Minimum API level to Android 5.0 (Lollipop)</b>
↓
<b>Go to XR Settings</b>
↓
<b>Check the Virtual Reality Supported checkbox &amp; Set Vuforia</b>

In the build settings, by default unity sets itself for PC, mac & Linux standalone environment. So, I switch the build mode to Android from PC, mac & Linux standalone.

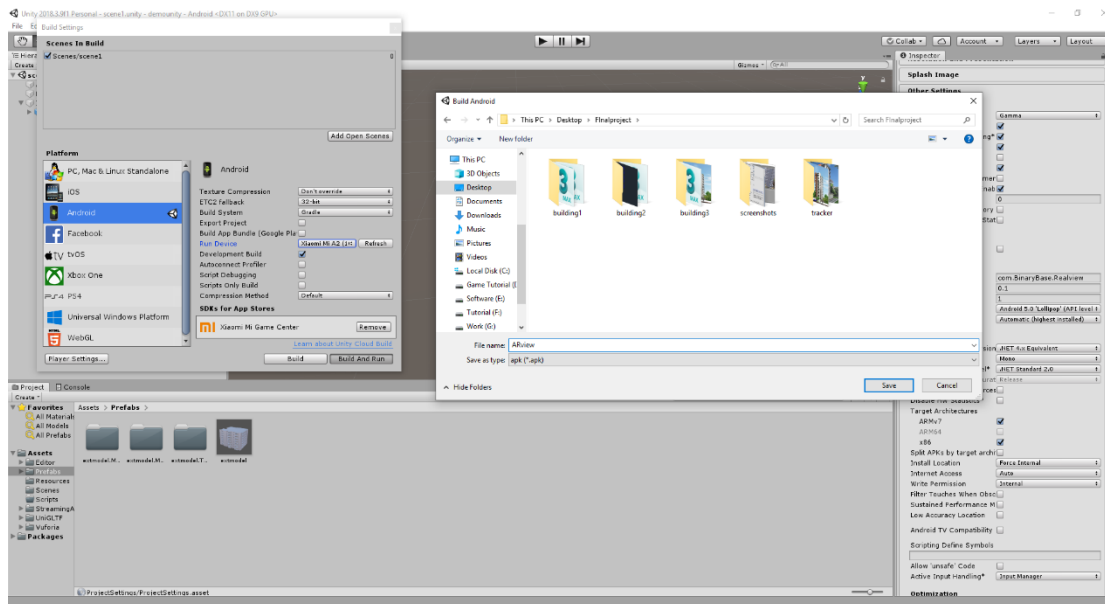


Figure 13: Unity Android Build Settings (A)



After switching the platform, I opened player settings and changed the orientation to landscape left from resolution & presentation. Then I have opened other settings and changed the package name & set the minimum android API level to Android 5.0 (Lollipop).

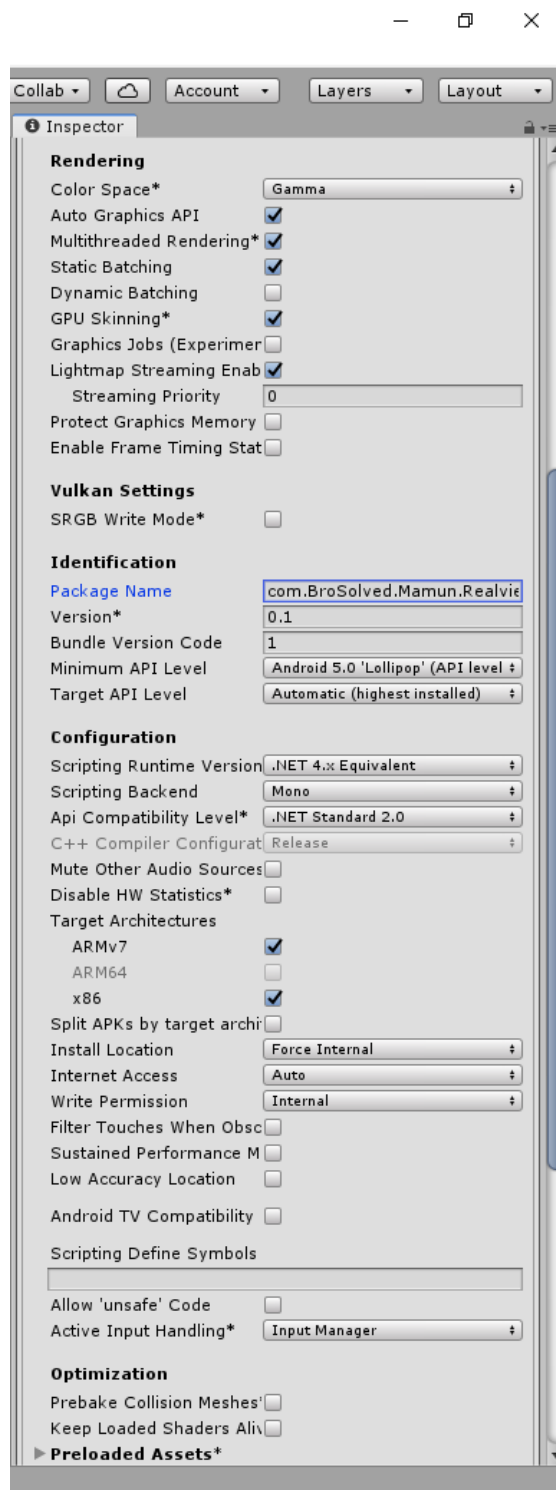


Figure 14 : Unity Other Settings (B)



Then I opened XR settings and checked the virtual reality supported checkbox & set Vuforia for augmented and virtual reality support. Now, my system is fully ready to develop augmented and virtual reality application.

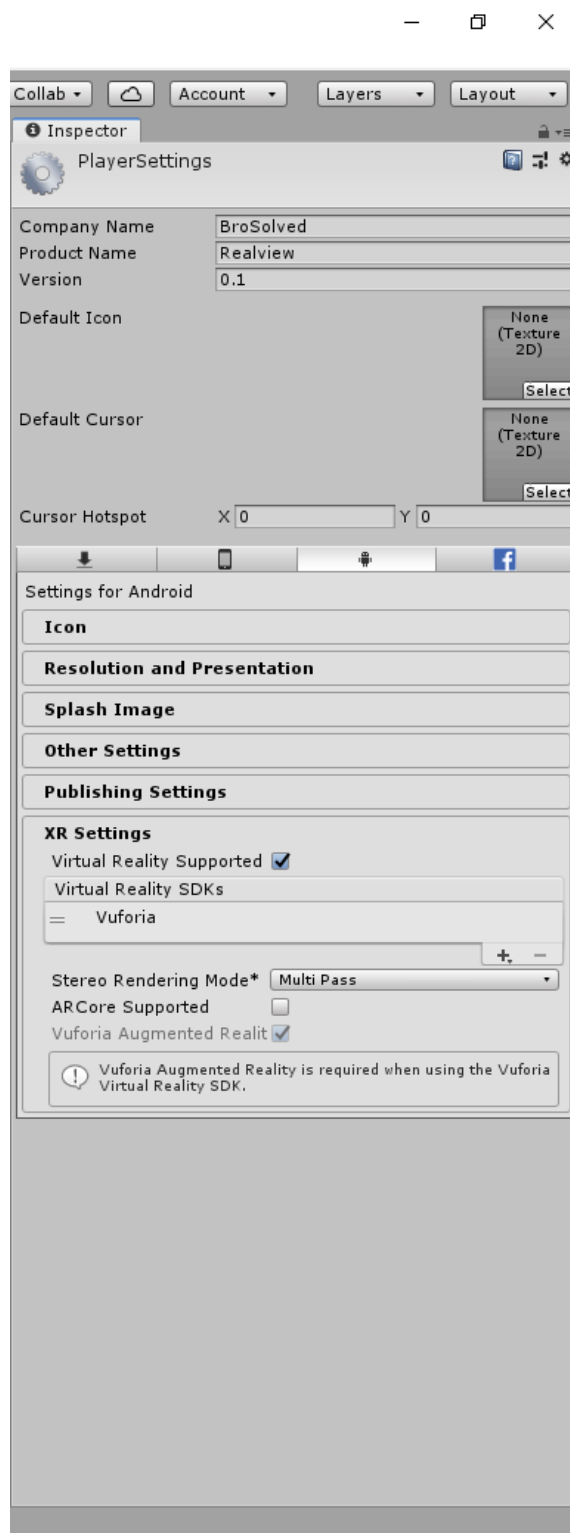


Figure 15 : Unity XR Settings

After Exporting from 3ds max using Babylon js in glTF [13] (GL Transmission Format) I need to import those models into unity. To import glTF models into unity I have to use a plugin called UniGLTF [14]. UniGLTF imports the glTF files as a prefab in unity. So, I created a folder named prefabs and I imported the models in glTF format into unity.

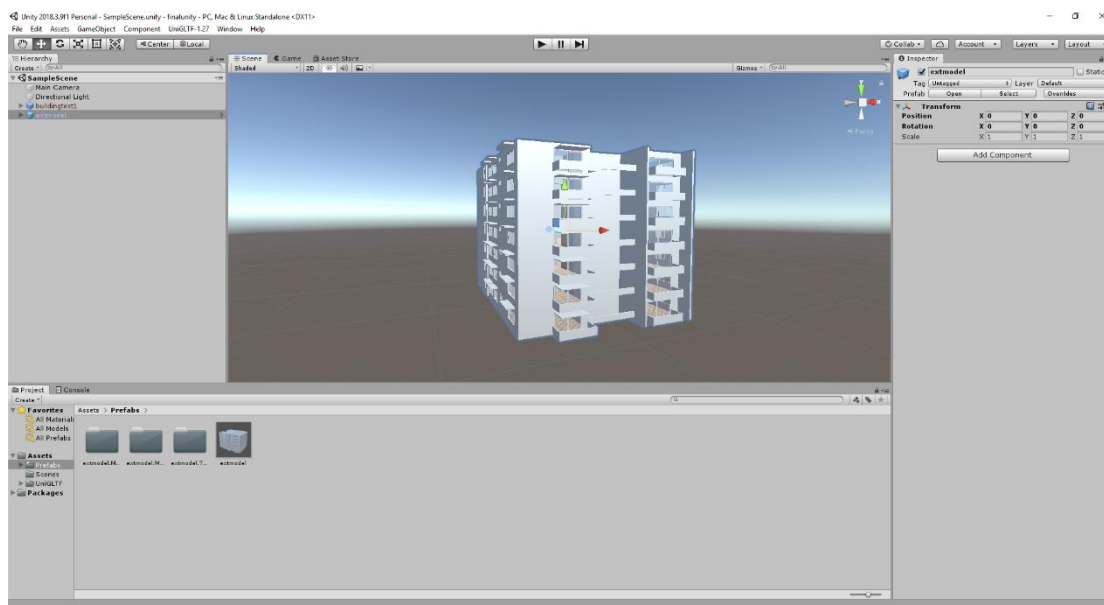


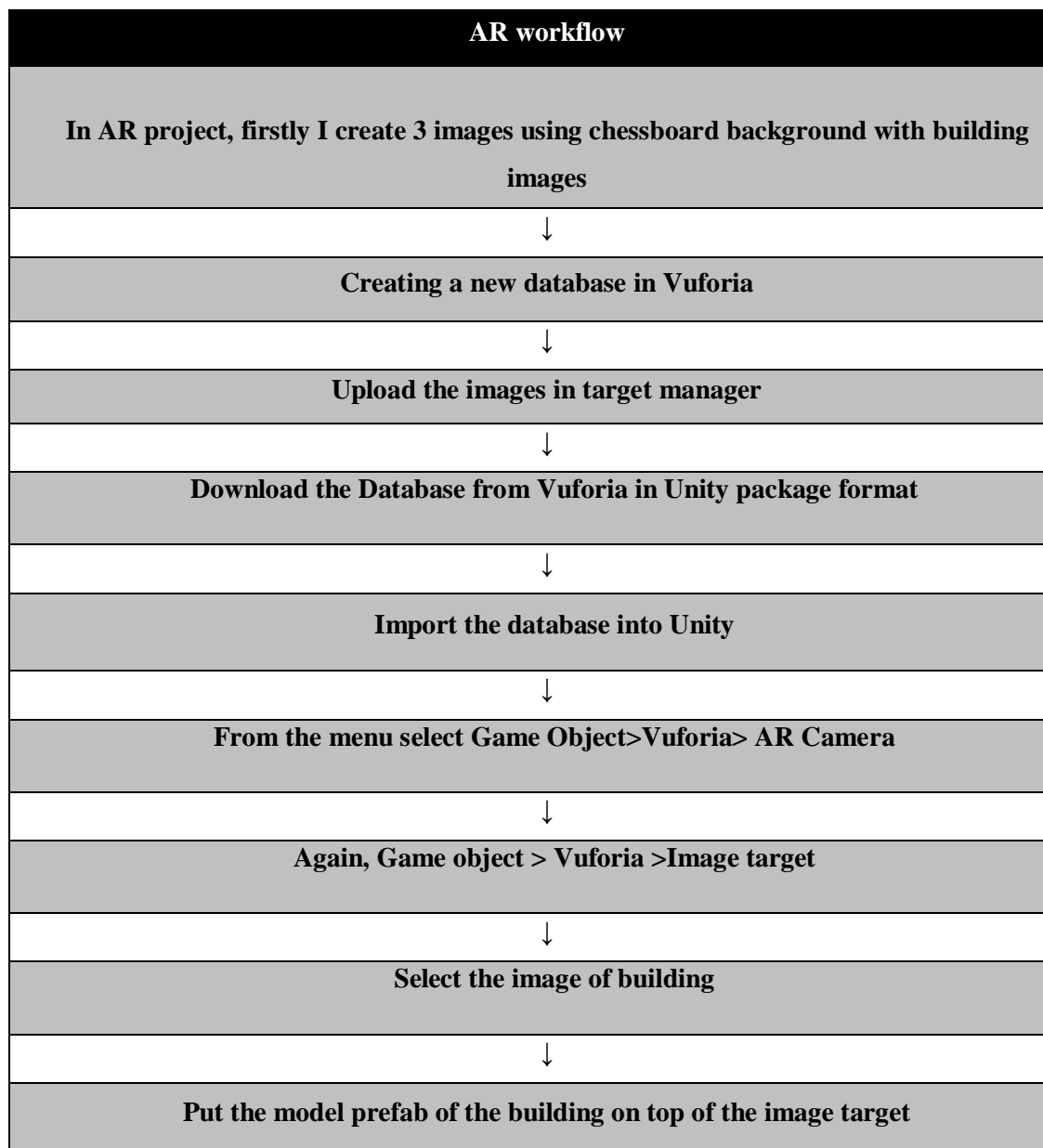
Figure 16 : Importing glTF files into unity using UniGLTF



## 4.5 AR workflow

To start developing AR project I have to make tracker images first. So, I created chessboard background with building images.

Table 2 : AR workflow







Then I logged into Vuforia development portal and created a new database for my application.

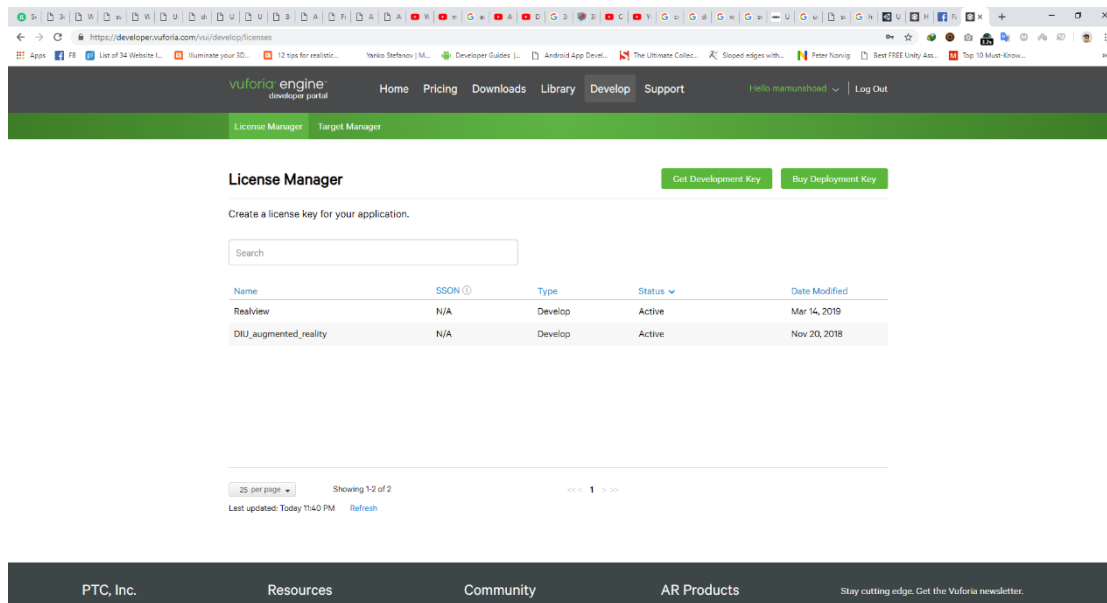


Figure 17 : Vuforia License manager

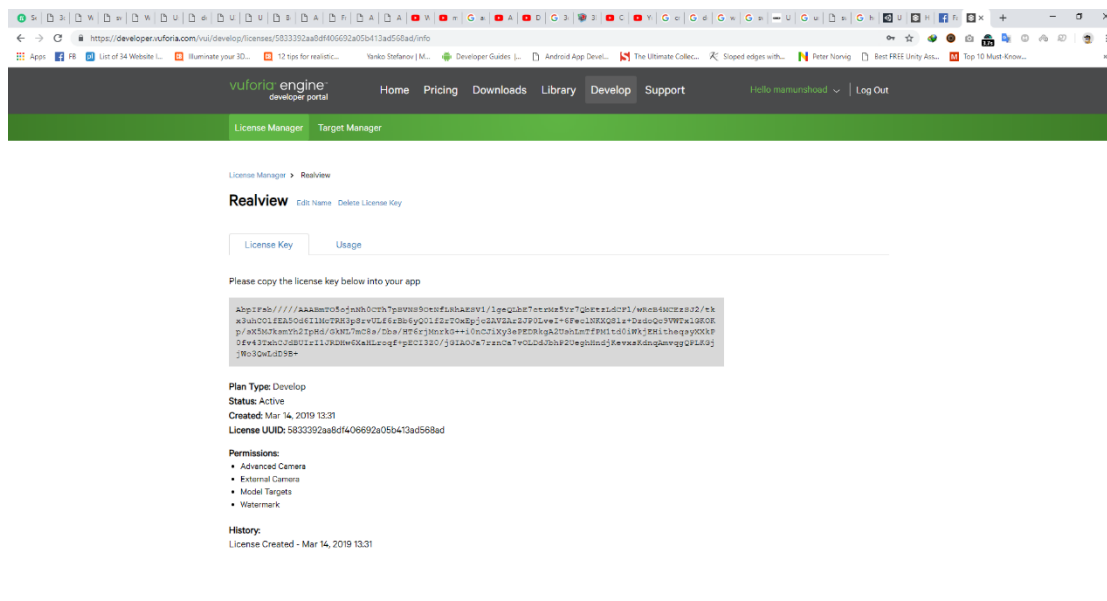


Figure 18 : Realview Vuforia License

Then I went into target manager and uploaded the images.

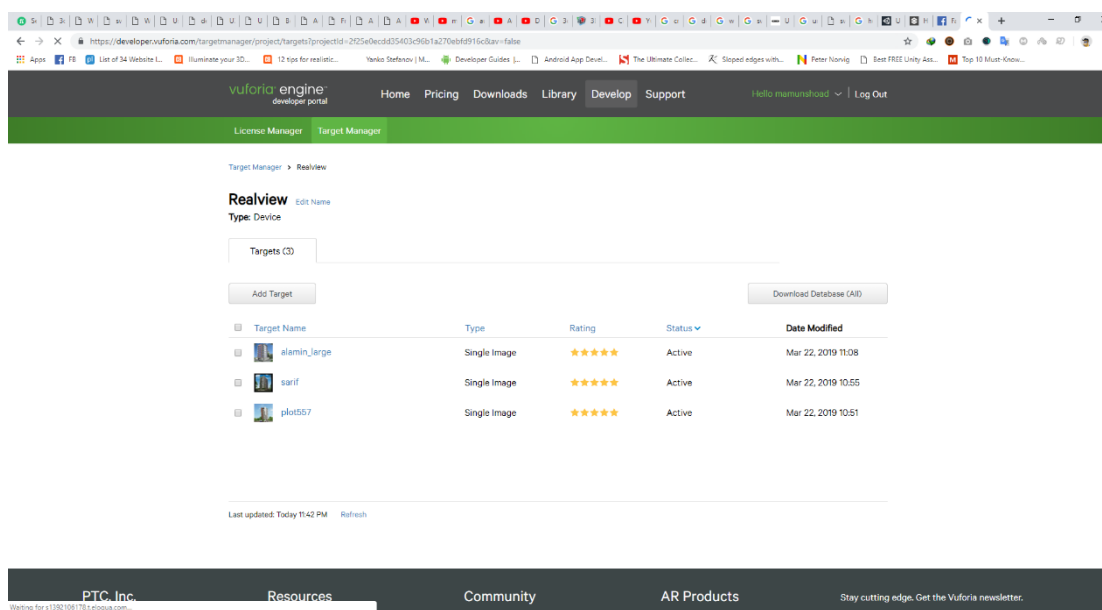


Figure 19 : Real View Image Target Manager

After sometime Vuforia analyzed the images and given me ratings for the images.

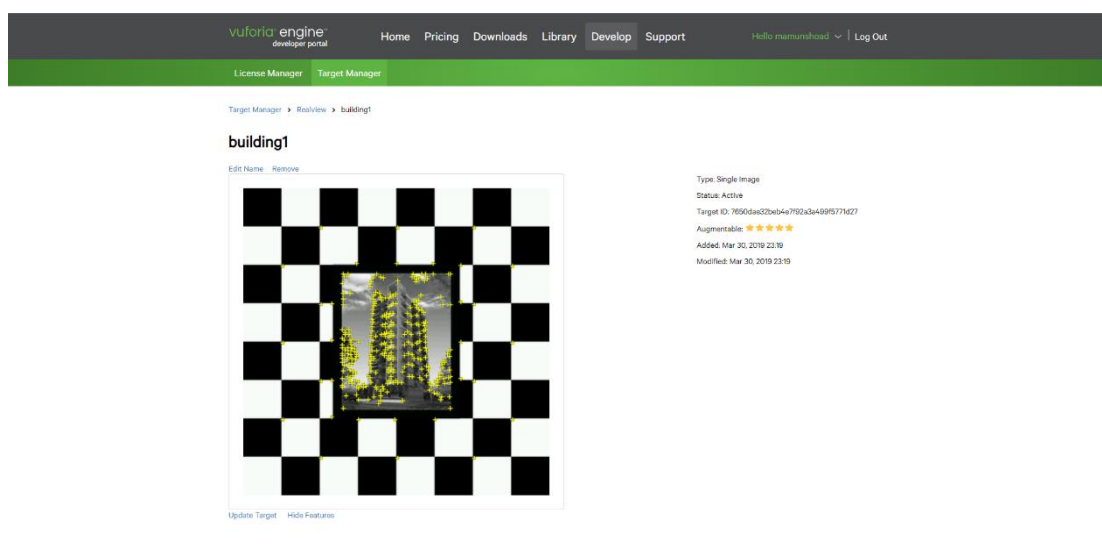


Figure 20 : Vuforia Image target for realview



Figure 21 : Realview Tracker Image 1



Figure 22 : Realview Tracker Image 2



Figure 23 : Realview Tracker Image 3

Then I downloaded the database from Vuforia in unity package format. After that I imported the database into unity.

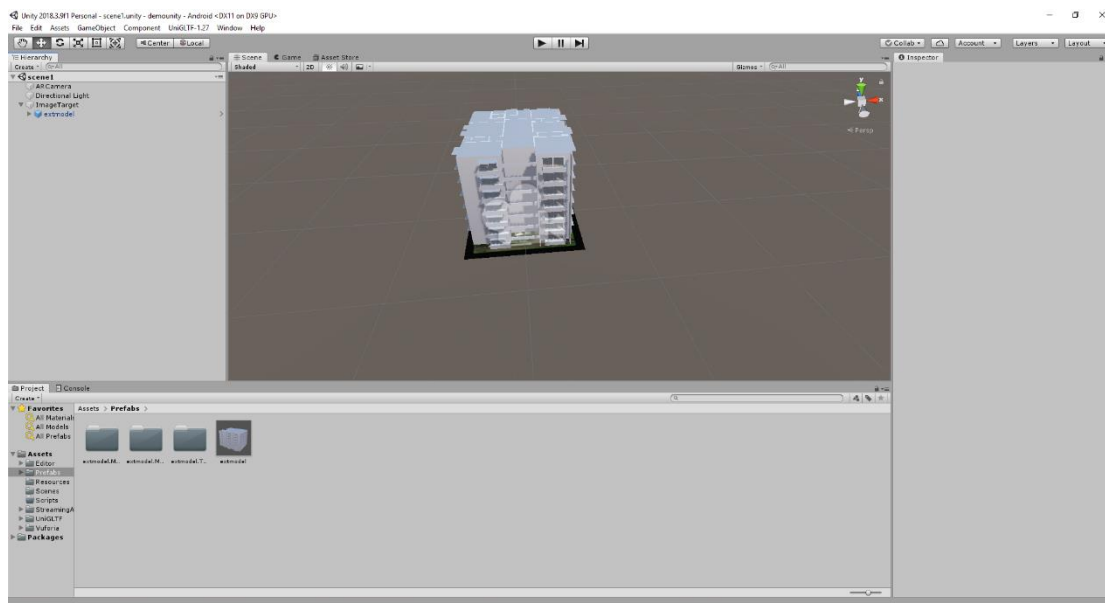


Figure 24: Model on image tracker

## 4.6 Normal View Workflow

Create a New Scene

Import the models as Prefabs.

Create an empty Game Object

Assign a script that will switch between Exterior and Interior models with the empty Game Object.

Create Button and assign the Empty Game Object on that.

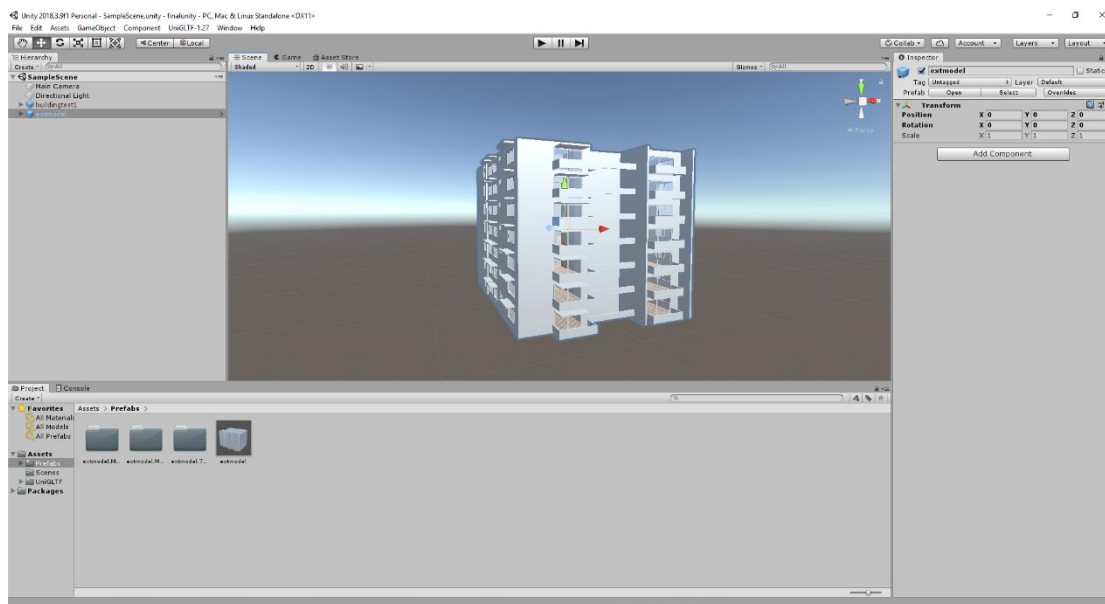


Figure 25: Unity Normal model view

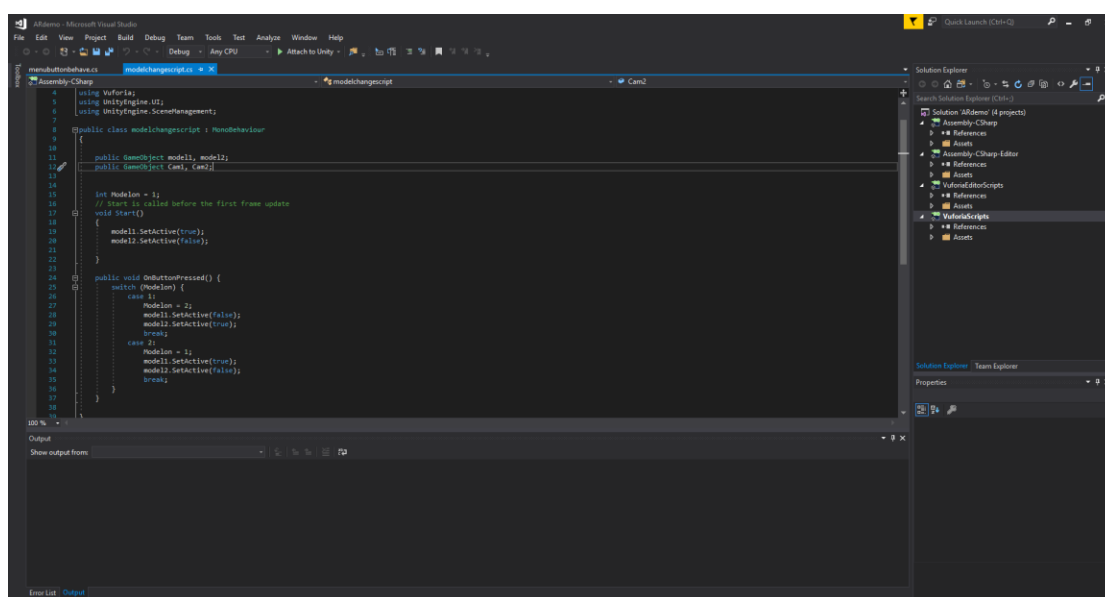


Figure 26 : Model changing script



## 4.7 VR workflow

For Virtual Reality View I have used Google Cardboard viewer [15]. For Virtual reality walking mode, I have to make the models walkable. For that I have to bake NavMesh [16] from the model.

Go to Window > AI > Navigation

Select the model parts that we want to bake as NavMesh.

Set the NavMesh Agent height and radius.

Bake the NavMesh.

Now the character can walk inside the model.

Import the Google Cardboard Viewer unity package into unity.

From Google VR > Prefabs > GvrEditorEmulator

Assign the GvrEditorEmulator into Hierarchy

From Google VR > Prefabs > Controller > GvrControllerMain

Assign the GvrControllerMain into Hierarchy

From Google VR > Prefabs > EventSystem > GvrEventSystem

Assign the GvrEventSystem into Hierarchy

From Google VR > Prefabs > Cardboard > GvrReticlePointer

Assign the GvrReticlePointer under the main camera as child object.

As the NavMesh was baked before now the character can walk inside of model.

Create an Empty Game Object, Name it Player.

Drag the main camera under the player to make it a child object of player.

Create an empty game object and name it VR Module.

Assign a Script that will contain Vr Scene Switching methods in VR Module.



Create a button and assign the Vr Module game object into the button.

Now the VR view will initiate when button clicked.

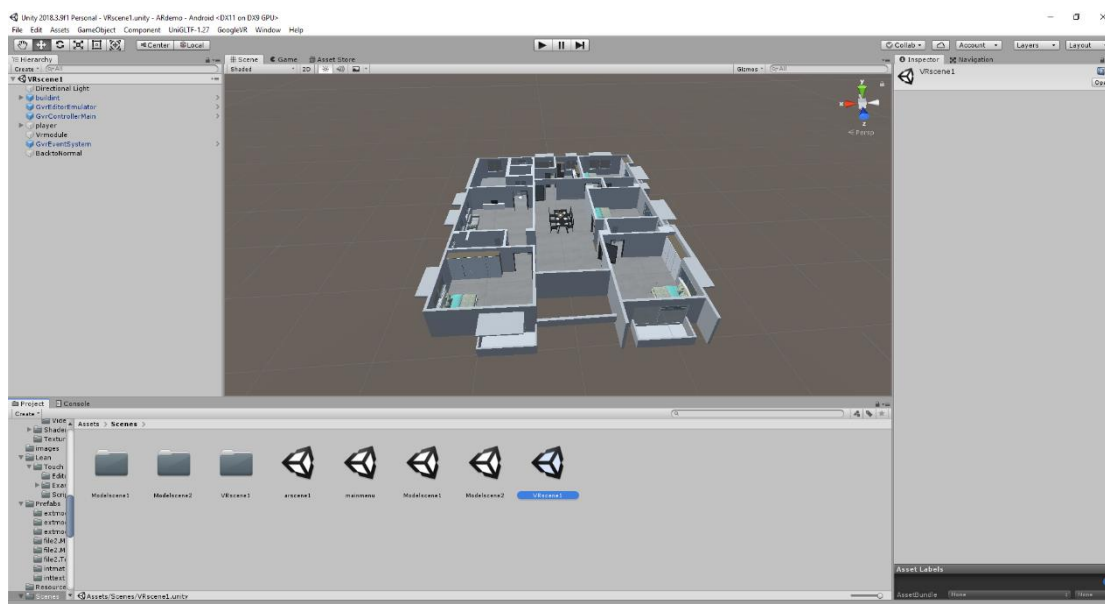


Figure 27: VR Workflow

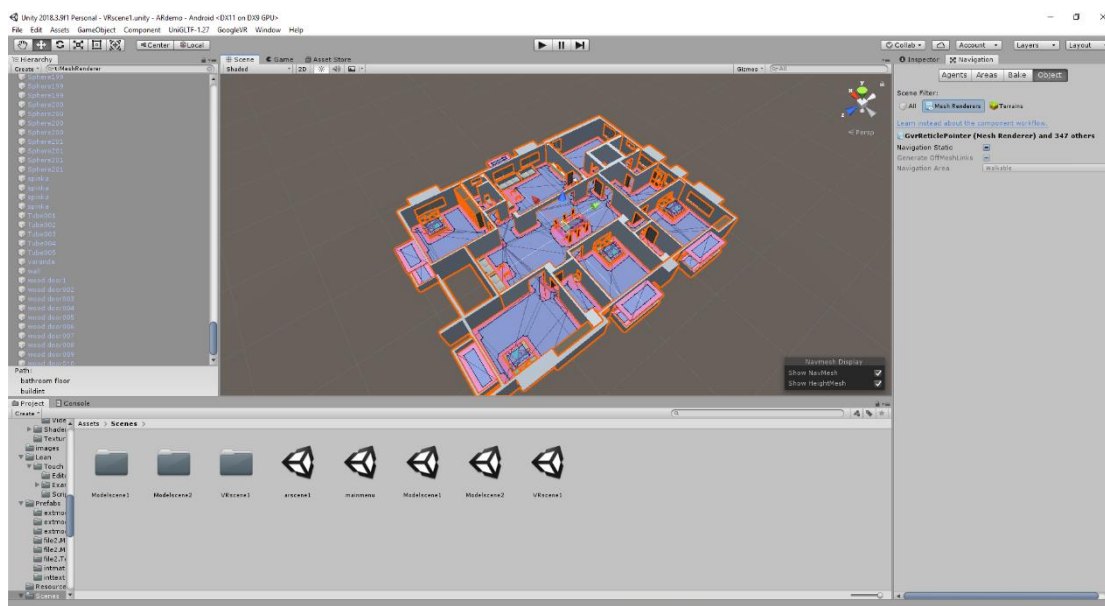


Figure 28 : NavMesh Baking



## 4.8 First Person View Workflow

For First Person View I have used Unity Standard Assets first person controller. For First person view I have to make the models walkable. For that I have to bake NavMesh from the model.

Go to Window > AI > Navigation

Select the model parts that we want to bake as NavMesh.

Set the NavMesh Agent height and radius.

Bake The NavMesh.

Now the FPS character can walk inside the model.

Import the Standard Assets [17] from Unity Asset Store [18].

From Standard Assets > Characters > First Person Controller > Prefabs > FPS Control

Assign the FPS Control into Hierarchy

As the NavMesh was baked before now the fps can walk inside of model.

Create an Empty Game Object, Name it Camera Switcher.

Assign a Script that will contain Camera Switching methods in Camera Switcher.

Create a button and assign the Camera Switcher game object into the button.

Now the Camera View Will be changed when button clicked.



Figure 29: FPS Controller





PC helped plan programming gives you a chance to structure 2D and 3D illustrations and models, supplanting customary pencil-and-paper drafting to make diagrams with effectively adjusted electronic records. In the "AutoCAD 2009 and AutoCAD LT 2009 Bible," Ellen Finkelstein composes that the product's discharge in 1982 denoted the first run through a CAD program was intended for use on PCs rather than centralized servers.[6]

## **History**

AutoCAD was gotten from a program that started in 1977, and after that discharged in 1979[4] called Interact CAD, additionally alluded to in early Autodesk records as a Micro CAD, which was composed preceding Autodesk's arrangement via Autodesk fellow benefactor Michael Riddle. Autodesk is the maker of AutoCAD and in addition AutoCAD LT programming, a less expensive form with fewer capacities discharged in 1993. At first accessible for Windows-based PCs just, AutoCAD wound up perfect with Apple items when AutoCAD for Mac hit store retires in 2010.

## **AutoCAD Uses**

Geographic data frameworks utilize AutoCAD programming to archive the forms of the land and situation of milestones. Transferring AutoCAD 3D documents into Autodesk Simulation programming enables specialists to make mechanical reenactments of plans for pressure examination and testing for obstruction between parts. AutoCAD illustrations likewise can progress toward becoming movements that give virtual voyages through an arranged building or deliver showings of how an item shows up when gathered. You can even fare AutoCAD documents to 3D printing administrations that utilization printers containing tar to make plastic parts or models of bigger plans.

## **Version history**

The local record arrangement of AutoCAD is .dwg. This and, to a lesser degree, its trade record design DXF, have progressed toward becoming true, if restrictive, norms for CAD information interoperability, especially for 2D drawing exchange AutoCAD has included help for. dwf, an organization created and advanced via Autodesk, for distributing CAD information. Autodesk's logo and, individually, AutoCAD symbols have changed for a few forms as the years progressed.



## Student versions

AutoCAD is authorized, for nothing, to understudies, teachers, and instructive foundations, with a three-year sustainable permit accessible. The understudy variant of AutoCAD is practically indistinguishable to the full business adaptation, with one special case: DWG records made or altered by an understudy rendition have an interior piece signal set. At the point when such a DWG document is printed by any form of AutoCAD more established than AutoCAD 2014 SP1, the yield incorporates a plot stamp/standard on every one of the four sides. Items made in the Student Version can't be utilized for business utilize. Understudy Version objects "taint" a business adaptation DWG document on the off chance that they are foreign made in renditions more seasoned than AutoCAD 2015.

## 5.2 Autodesk 3DS MAX



Figure 32: Autodesk 3DS Max

### Autodesk 3ds Max

Autodesk 3ds Max, in the past 3D Studio and 3D Studio Max, is an expert 3D PC designs program for making 3D activity's, models, recreations and pictures. It is made and conveyed by means of Autodesk Media and Entertainment [19]. It has showing capacities and versatile module designing and can be used on the Microsoft Windows. It is every now and again utilized by computer game engineers, numerous TV ad studios and design representation studios. It is additionally utilized for motion picture impacts and film pre-representation. For its displaying and liveliness devices, the



most recent version of 3ds Max additionally includes shaders, unique recreation, molecule frameworks, radiosity is a utilization of the limited component strategy to unraveling the rendering condition for scenes with surfaces that reflect light diffusely). Typical guide creation and rendering, worldwide brightening, an adaptable UI, new symbols, and its own scripting dialect.

### Version

3Ds Max has lots of versions. But we are knowing this kind of version:

Table 3:Auto desk 3DS Max Version

Version	Codename	Year	Operating system	Hardware platform
Autodesk 3ds Max 2014	Tekken	2013	<u>Windows 7</u>	x64
Autodesk 3ds Max 2015	Elwood	2014	<u>Windows 7</u> and <u>Windows 8</u>	
Autodesk 3ds Max 2016	Phoenix	2015	<u>Windows 7</u> , <u>Windows 8</u> and <u>Windows 8.1</u>	
Autodesk 3ds Max 2017	Kirin	2016	<u>Windows 7</u> , <u>Windows 8</u> , <u>Windows 8.1</u> and <u>Windows 10</u>	
Autodesk 3ds Max 2018	Imoogi	2017		
Autodesk 3ds Max 2019	Neptune	2018		

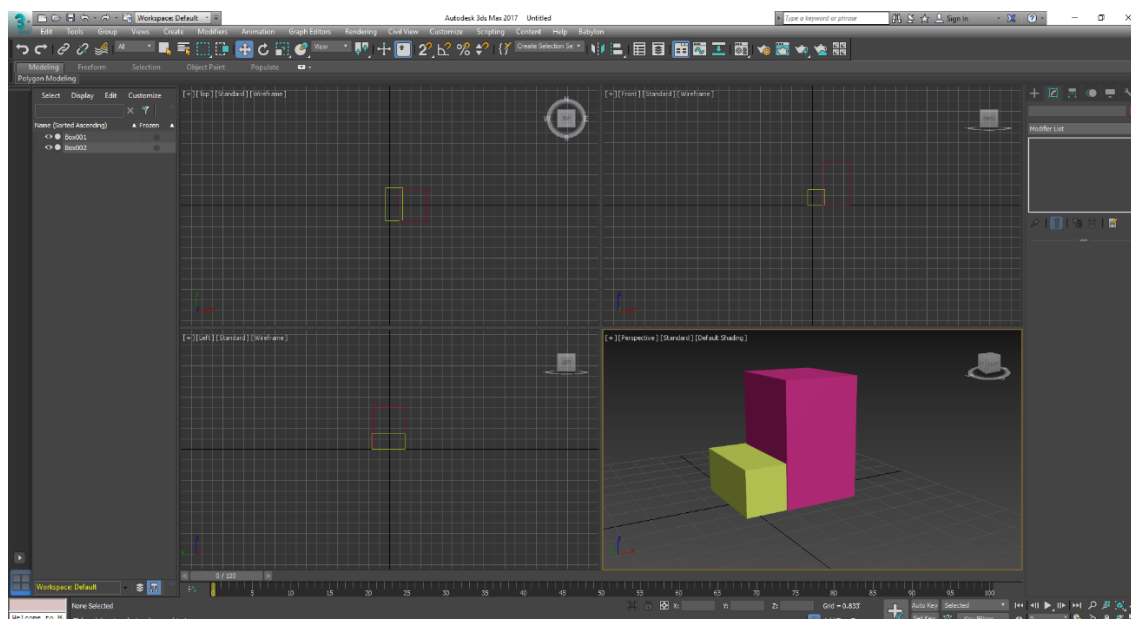


Figure 33: This is the Autodesk 3ds MAX interface

## Modeling techniques

Polygon modeling

NURBS (Non-Uniform Rational B-Splines)

Surface tool/editable patch object

Polygon modeling is more typical with a division plan than some other displaying strategy as the simple particular command over individual polygons takes into account outrageous advancement.

An option in contrast to polygons, it gives a smoothed-out surface that dispenses with the straight edges of a polygon display. NURBS is a scientifically correct portrayal of freestyle surfaces like those utilized for vehicle bodies and ship structures, which can be actually replicated at any goals at whatever point required. With NURBS, a smooth circle can be made with just a single face.

The surface instrument was initially an outsider module; however, Kinetix gained and incorporated this component since variant 3.0. The surface apparatus is for making normal 3ds Max splines and after that applying a modifier called "surface." This modifier makes a surface from every three or four vertices in a network.





## **Project Workflow**

Each venture is unique, however, there are by and large advances that apply to almost every model you make with 3ds Max. Once you've introduced 3ds Max, begin the program by double-tapping its work area alternate way.

Note: You can likewise begin 3ds Max from the Start menu or utilize some other standard Windows strategy. On the off chance that you begin 3ds Max from a Command Prompt window or a group record, you can include order line switches. 3ds Max is a "lone report application," which implies you can tackle only a solitary scene at some random minute. You can run numerous occurrences of 3ds Max and open an alternate scene in each example, however doing as such requires a considerable measure of memory.

## **Topics in this section**

Planning Ahead

Modeling

Lights and Cameras

Animating Characters

General Animation

Rendering for Final Results

How far you prepare is dependent upon you. Be that as it may, it can realize how 3ds Max shows models. To make a model, you can begin with an assortment of 3D geometric natives. Materials control the presence of the surfaces of articles. You make lights with different properties to enlighten your scene. Characters make enthusiasm, connecting with one another or with articles in the scene. You can vitalize protests and in addition characters. Rendering adds shading and shading to your scene

### 5.3 UNITY 3D



Figure 34 : Unity3d Logo



Figure 35: This area is your vital component to the beginning with Unity3d

Unity (game engine) As of 2018, the engine has been extended to support 27 platforms. The engine can be utilized to make both three-dimensional and two-dimensional amusements and additionally reenactments for its numerous stages.

Unity is a cross-stage diversion engine created by Unity Technologies, previously reported and discharged in June 2005 at Apple Inc.'s Worldwide Developers Conference as an OS X-exclusive amusement engine. Starting in 2018, the engine has been reached out to help 27 platforms. The engine can be utilized to make both three-dimensional and two-dimensional amusements and also reenactments for its



numerous stages. A few noteworthy adaptations of Unity have been discharged since its dispatch, with the most recent stable variant being Unity 2019.1.2, discharged on May 10, 2019.

## **Overview**

Unity enables clients to make amusements in both 2D and 3D, and the motor offers an essential scripting API in C#, for both the Unity proofreader as modules, and recreations themselves, and also simplified usefulness. Before C# being the essential programming dialect utilized for the motor, it recently upheld Boo, which was expelled in the Unity 5 discharge, and a variant of JavaScript called Unity Script, which was deployed in August 2017 after the arrival of Unity 2017.1

The motor has bolstered for the accompanying illustrations APIs: Direct3D on Windows and Xbox One; OpenGL on Linux, Mac OS, and Windows; OpenGL ES on Android and iOS; WebGL. Also, Unity underpins the low-level APIs Metal on iOS and macOS and Vulkan on Android, Linux, and Windows, and also Direct3D 12 on Windows and Xbox One.

Inside 2D amusements, Unity permits the importation of sprites and a progressed 2D world renderer. For 3D diversions, Unity permits detail of surface pressure, mipmaps, and goals settings for every stage that the amusement motor supports, and offers help for knock mapping, reflection mapping, parallax mapping, screen space including hindrance (SSAO), dynamic shadows using shadow maps, render-to-surface, and full-screen post-planning impacts.

Since around 2016 Unity likewise offers cloud-based administrations to designers, these are by and by Unity Ads, Unity Analytics, Unity Certification, Unity Cloud Build, Unity Every play, Unity IAP, Unity Multiplayer, Unity Performance Reporting, Unity Hub and Unity Collaborate.

## **VR overview**

Solidarity VR gives you a chance to target computer-generated reality gadgets straightforwardly from Unity, with no outer modules in undertakings. It gives a base API and list of capabilities with similarity for different gadgets. It has been intended to give forward similarity to future gadgets and programming.



Solidarity XR API has been invigorated to reflect the broader umbrella term "XR" yet a critical piece of the documentation right currently still uses the articulation "VR". The XR API surface is irrelevant by design, anyway will reach out as XR continues creating.

By utilizing the local VR bolster in Unity, you gain:

- Stable variants of each VR gadget
- A single API interface to communicate with various VR gadgets
- A clean venture organizer with no outer module

for every gadget

- The capacity to incorporate and switch between various gadgets in your applications
- Increased execution (Lower-level Unity motor improvements are workable for local gadgets).

### **Empowering Unity VR Support**

To empower local VR to bolster for your diversion assembles and the Editor, open the Player Settings

(Menu: Edit > Project Settings > Player)

Select XR Settings and check the Virtual Reality Supported checkbox. Set this for each frame target. Enabling PC created reality to reinforce in an autonomous frame does not moreover engage the assistance for Android (and the different way).

Utilize the Virtual Reality SDKs list showed underneath the checkbox to include and expel VR gadgets for each forming target. The request of the rundown is the request that Unity attempts to empower VR gadgets at runtime. The main gadget that instates legitimately is the one empowered. This rundown arrange is the equivalent in the constructed player.

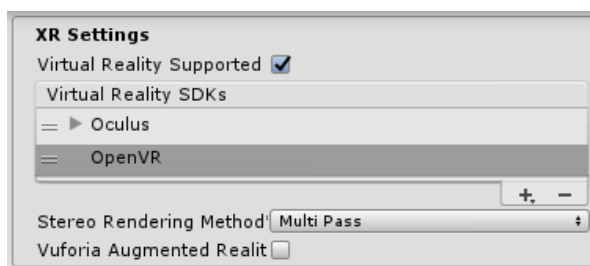


Figure 36: XR settings

### **Built applications: Choosing a startup device**

we created application in states and engages contraptions in indistinct demand from the Virtual Reality SDKs list in XR Settings [20] (see Enabling VR Support, above). Contraptions not present in the once-over at develop time are not open in the last shape. Contraption None is proportionate to a non-VR application (that is, a common Unity application) and can be changed to in the midst of runtime without fusing it in the summary; the uncommon case to this is None.

Counting None as a gadget in the rundown enables you to default to a non-VR application before endeavoring a VR gadget's introduction. On the off chance that you put None at the highest priority on the rundown, the application begins with VR debilitated. At that point, you would then be able to empower and incapacitate VR gadgets that are available in your rundown through content utilizing XR.XR Settings. Load Device by Name. In the event that introduction of the gadget you endeavor to change to falls flat, Unity handicaps VR with that gadget still set as the dynamic VR gadget. When you switch gadgets or empower XR, the constructed application endeavors to instate once more.

The order line contention used to dispatch a particular gadget is - `vrmode DEVICETYPE` where `DEVICETYPE` is one of the names from the upheld XR bolstered gadgets list.

### **What happens when VR is enabled**

VR is empowered in Unity; a couple of things happen consequently:



## Automatic rendering to a head-mounted display

All Cameras in your Scene can render specifically to the head-mounted showcase (HMD). View and Projection grids are naturally changed in accordance with record for head following, positional following and field of view. It is conceivable to handicap rendering to the HMD utilizing the Camera part's stereo Target Eye property. On the other hand, you can set the Camera to render to a Render Texture utilizing the Target Texture property.

Utilize the stereo Target Eye property to set the Camera to just render a particular eye to the HMD. This is helpful for embellishments, for example, an expert marksman scope or stereoscopic recordings. To accomplish this, add two Cameras to the Scene: one focusing on the left eye, the other focusing on the correct eye. Set layer covers to design what is sent to each eye.

## Understanding the camera

The Camera Transform is superseded with the head-followed present. To move or pivot the Camera, join it as an offspring of another Game Object. This influences it with the goal that all to change changes to the parent of the Camera influence the Camera itself. This likewise applies to move or pivoting the camera utilizing a content.

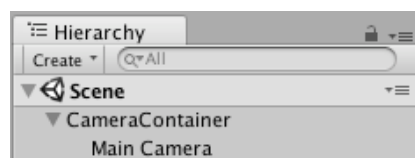


Figure 37: Hierarchy

## Equipment and programming proposals for VR advancement in Unity

Accomplishing an edge rate like your objective HMD is fundamental for a decent VR encounter. This must match the revive rate of the showcase utilized in the HMD. On the off chance that the casing rate dips under the HMD's invigorate rate, it is especially perceptible and frequently prompts queasiness for the player.



## **Programming**

Windows: Windows 7, 8, 8.1, and Windows 10 are largely good.

Android: Android OS KitKat4.4 or higher.

Graphics card drivers: Make beyond any doubt your drivers are up and coming. Each gadget is staying aware of the most up to date drivers, so more established drivers may not be upheld.

## **Device runtime requirements**

Each VR gadget necessitates that you have suitable runtime introduced on your machine. For instance, to create and run Oculus rift [21] inside Unity, you need the Oculus runtime (otherwise called Oculus Home) introduced on your machine. For HTC Vive [22], you need Steam and SteamVR [23] introduced. Contingent upon what variant of Unity you are utilizing, the runtime adaptations for every particular gadget that is bolstered by Unity may vary. You can discover runtime forms in the discharge notes of each major and minor Unity discharge. With some form refreshes, past runtime renditions are never again bolstered. This implies local Unity VR bolster does not work with prior runtime variants, but rather keeps on working with new runtime renditions.

Solidarity local VR bolster does not peruse modules from inside your task's envelope, so including prior variants of the module with local help will come up short on the off chance that you have VR bolster empowered. On the off chance that you wish to utilize a prior rendition with an arrival of Unity that never again underpins that form, incapacitate Native VR Support (go to XR Settings and uncheck Virtual Reality Supported). You would then be able to get to the module like some other outsider module. See the area above on Enabling Unity VR Support for more subtle elements.

## **Vuforia**

Vuforia [24] is a cross-stage Augmented Reality (AR) and Mixed Reality application advancement stage, with hearty following and execution on an assortment of equipment. Solidarity's joining of Vuforia enables you to make vision applications and diversions for Android and iOS utilizing an intuitive creating work process. A

Vuforia AR+VR tests bundle is accessible on the Unity Asset Store., with a few helpful models exhibiting the most imperative highlights of the stage.

### **Marker-based tracking**

In AR or MR, markers are pictures or protests enrolled with the application which go about as data triggers in your application. At the point when your gadget's camera perceives these markers, in reality, this triggers the showcase of virtual substance over the world position of the marker in the camera sees. The marker-based following can utilize a wide range of marker types, including QR codes, physical intelligent markers, Image Targets, and 2D labels. The least difficult and most basic sort of marker in diversion applications is an Image Target.

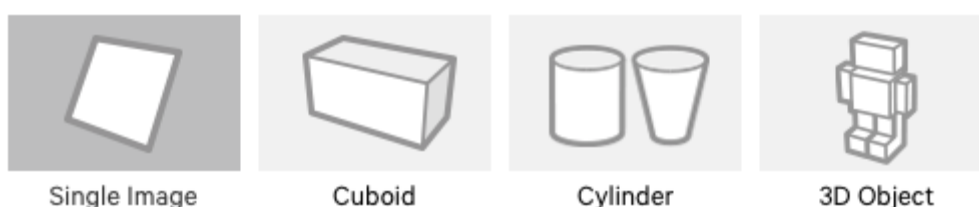


Figure 38: Marker based tracking

### **Image Targets**

Image Targets are a particular kind of marker utilized in the Marker-based following. They are pictures you physically enroll with the application and go about as triggers that show virtual substance. For Image Targets, utilize pictures containing particular shapes with complex blueprints. This makes it simpler for picture acknowledgment and following calculations to remember them.

### **Markerless following**

Applications utilizing Marker less following are all the more general area based or position-based Augmented or Mixed Reality. This type of following depends on advancements, for example, GPS, accelerometer, spinner and more unpredictable picture handling calculations, to put virtual items or data in the earth. The VR equipment and programming at that point regards these articles as though they are tied down or associated with particular true areas or items.



## 5.4 Adobe Photoshop



Figure 39: Adobe Photoshop

Photoshop was created in 1987 by the American siblings Thomas and John Knoll, who sold the dispersion permit to Adobe Systems Incorporated in 1988. It can alter and create raster pictures in numerous layers and backings covers, alpha compositing and a few shading models including RGB, CMYK, CIELAB, spot shading, and duotone. Notwithstanding raster illustrations, it has restricted capacities to alter or render content, vector designs (particularly through cut-out way), 3D designs and video.



Figure 40: This is the Adobe Photoshop interface



We are working Photoshop CC 2015 was developed on June 15, 2015, In this version was lots of function and very user-friendly, some new feature was -

Artboards

Adobe Stock marketplace

Design Space (Preview) offers a designated mode for websites and mobile apps designers

Camera Raw as a filter

Some Layer styles can now be added up to 10 instances

Redesign image export feature

Adobe Camera Raw 9.1

Linked files in CC Libraries

Real-time healing previews.

### **File Format**

Photoshop records have default document augmentation as PSD, which stands for "Photoshop Document." A PSD record stores a picture with help for most imaging choices accessible in Photoshop. These incorporate layers with veils, straightforwardness, content, alpha channels and spot hues, cutting ways, and duotone settings. This is rather than numerous other record groups (e.g., .JPG or .GIF) that confine substance to give streamlined, unsurprising usefulness. A PSD document has a most extreme tallness and width of 30,000 pixels, and a length point of confinement of two gigabytes.

As far as possible was obviously picked subjectively by Adobe, not founded on PC math imperatives (it isn't near an intensity of two, as is 30,000) however for simplicity of programming testing. PSD and PSB groups are recorded. Due to Photoshop's fame, PSD documents are broadly utilized and upheld to some degree by most contending programming. The .PSD record configuration can be sent out to and from Adobe's different applications like Adobe Illustrator, Adobe Premiere Pro, and After Effects.

## Photoshop tools

After stacking Photoshop, a sidebar with an assortment of devices with numerous pictures altering capacities appears to one side of the screen. These devices normally fall under the classes of illustration; painting; estimating and route; determination; composting; and retouching.

## 5.5 Adobe Illustrator



Figure 41: Adobe Illustrator

Adobe Illustrator [25] is a vector designs proofreader created and promoted by Adobe Systems. Initially intended for the Apple Macintosh.

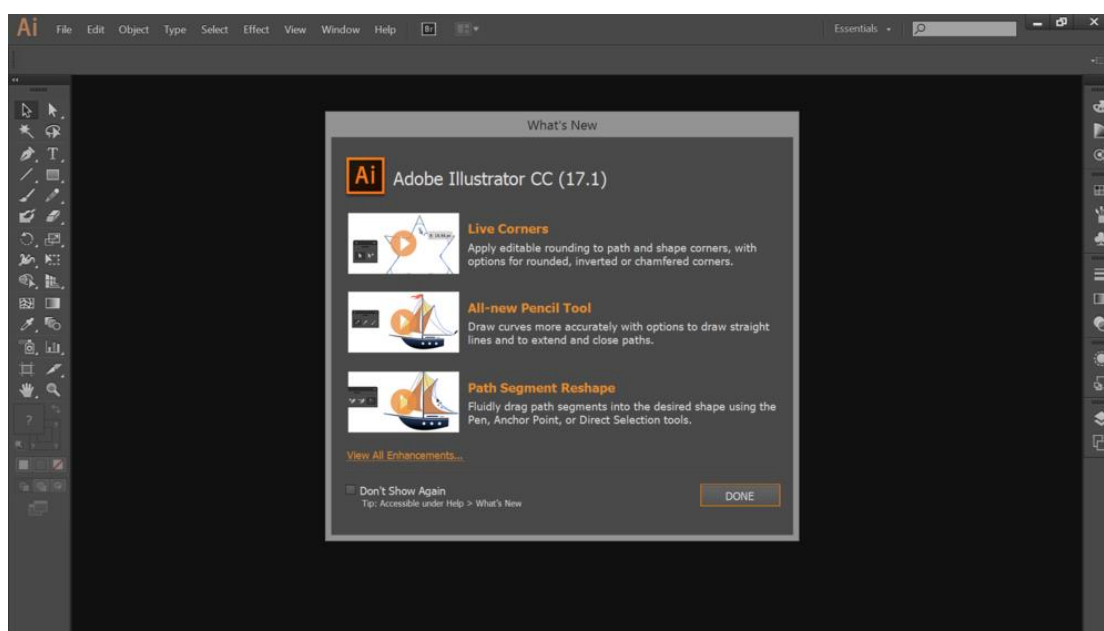


Figure 42: The is the adobe illustrator interface



## **Version CC**

Alongside Creative Cloud, Illustrator CC was discharged. This form was the first to be just sold in a membership-based administration demonstrate, in accordance with the other programming in the once called Creative Suite. As a component of Creative Cloud, this rendition acquired upgrades that subject, for example, shading, text style and program settings matching up, sparing records to the cloud, and reconciliation with Balance and different highlights, for example, another touch-perfect sort device, pictures in brushes, CSS extraction, and documents bundling.

The most current test for -Illustrator is additionally one of Rob's most loved applications. Like many Photoshop users, when first learning it- he was frustrated with the tools and the different way of working! However, when a fashioner figures out how mind-boggling Illustrator is that you get to really fabricate interminably scale-capable pictures without any preparation you'll be snared.

## **Tools**

A sidebar that shows up at the left of the screen with an assortment of instruments to choose, make, and control items or fine arts in Illustrator. These apparatuses can be chosen as following: drawing, composing, painting, reshaping, cutting and cutting, imagery, moving and zooming, and graph. Some instruments have a little triangle at the base right of the tool stash symbol. A little triangle has the choice to see or grow some shrouded instruments by hold down the mouse catch on the triangle.

A few models of fundamental apparatuses in artist are determination devices, paintbrush instruments, pen devices, pencil devices e.g. Determination instruments are utilized to the format, change, and sort out the work of art by choosing, situating, and stacking object precisely. In addition, choice apparatuses can gather, bolt or cover up, and measure objects. Paintbrush devices can be utilized to adjust the presence of the fine art. There are distinctive kinds of brushes: calligraphic, dissipate, workmanship, design, and bristle. Pen devices make straight and bent lines for the fine art and they can add grapple focuses to ways and erase from ways. Pencil devices enable the client to draw and alter freehand lines.



## 5.6 Visual Studio



Figure 43: Visual Studio

Microsoft Visual Studio [26] is an incorporated improvement condition (IDE) from Microsoft. It is utilized to create PC programs, just as sites, web applications, web administrations and portable applications. Visual Studio utilizes Microsoft programming improvement stages, for example, Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can deliver both local code and oversaw code.

Visual Studio incorporates a code supervisor supporting IntelliSense (the code fruition segment) just as code refactoring. The incorporated debugger works both as a source-level debugger and a machine-level debugger. Other inherent instruments incorporate a code profiler, shapes creator for structure GUI applications, website specialist, class planner, and database pattern fashioner. It acknowledges modules that upgrade the usefulness at pretty much every dimension—including support for source control frameworks (like Subversion and Git) and including new toolsets like editors and visual planners for area explicit dialects or toolsets for different parts of the product advancement lifecycle (like the Team Foundation Server customer: Team Explorer).

Visual Studio bolsters 36 diverse programming dialects and permits the code manager and debugger to help (to differing degrees) almost any programming language, gave a language-explicit administration exists. Worked in dialects incorporate C, C++, C++/CLI, Visual Basic .NET, C#, F#, JavaScript, TypeScript, XML, XSLT, HTML, and CSS. Backing for different dialects, for example, Python, Ruby, Node.js, and M among others is accessible by means of modules. Java (and J#) were bolstered previously.



The most essential release of Visual Studio, the Community version, is accessible for nothing out of pocket.

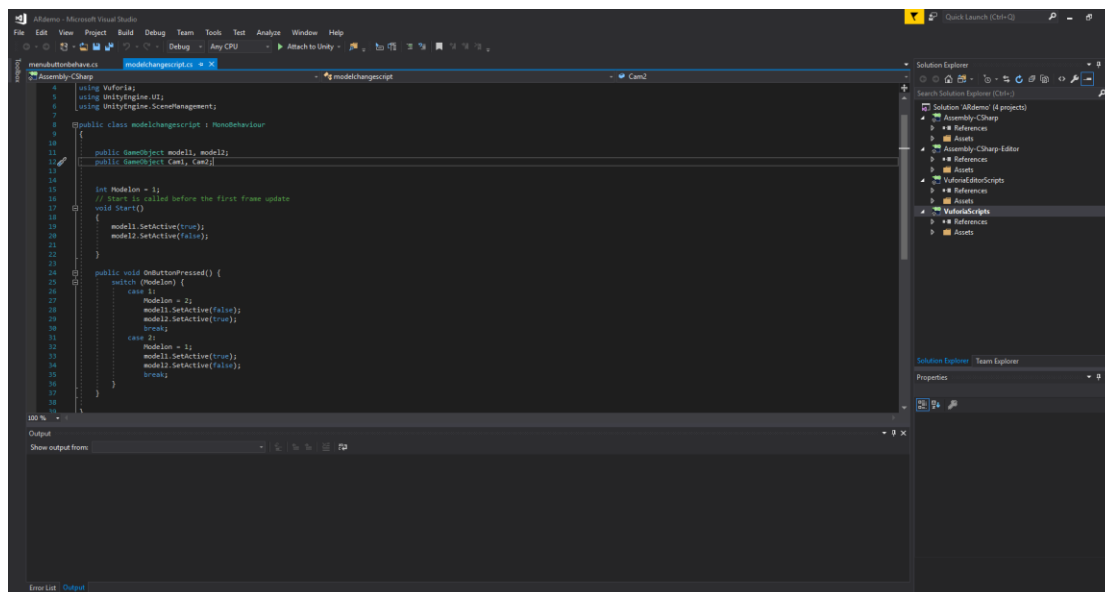


Figure 44: Visual Studio Interface

## History

The first version of visual studio was visual studio 97, Before that Visual Basic, Visual C++, Visual FoxPro and Visual SourceSafe was sold separately.

Product name	Codename	Version number	Supported .NET Framework versions	Supported .NET Core versions	Release date
Visual Studio 2019 <sup>[60]</sup>	Unknown	16.0	3.5 - 4.8 <sup>[61]</sup>	To be announced	April 2, 2019 <sup>[62]</sup>
Visual Studio 2017 <sup>[63]</sup>	<i>Dev15</i> <small>[citation needed]</small>	15.0	3.5 - 4.7 <sup>[64]</sup>	1.0-1.1, <sup>[65]</sup> 2.0 <sup>[66]</sup>	March 7, 2017
Visual Studio 2015	<i>Dev14</i> <small>[citation needed]</small>	14.0	2.0 - 4.6	1.0	July 20, 2015
Visual Studio 2013	<i>Dev12</i> <small>[citation needed]</small>	12.0	2.0 - 4.5.2	N/A	October 17, 2013
Visual Studio 2012	<i>Dev11</i> <small>[citation needed]</small>	11.0	2.0 - 4.5.2	N/A	September 12, 2012
Visual Studio 2010	<i>Dev10</i> , <sup>[67]</sup> <i>Rosario</i> <sup>[68]</sup>	10.0	2.0 - 4.0	N/A	April 12, 2010
Visual Studio 2008	<i>Orcas</i> <sup>[69]</sup>	9.0	2.0, 3.0, 3.5	N/A	November 19, 2007
Visual Studio 2005	<i>Whidbey</i> <sup>[70]</sup>	8.0	2.0, 3.0	N/A	November 7, 2005
Visual Studio .NET 2003	<i>Everett</i> <sup>[71]</sup>	7.1	1.1	N/A	April 24, 2003
Visual Studio .NET (2002)	<i>Rainier</i> <sup>[72]</sup>	7.0	1.0	N/A	February 13, 2002
Visual Studio 6.0	<i>Aspen</i> <sup>[73]</sup>	6.0	N/A	N/A	June 1998
Visual Studio 97	<i>Boston</i> <sup>[74]</sup>	5.0	N/A	N/A	February 1997

Figure 45: Visual Studio version history



For my project I have use Visual Studio Community edition 2017. Unity supports Visual Studio since Unity 2017.01 Version deprecating Mono develop [27] as its Primary IDE. But Now Visual Studio is the primary IDE of Unity3D.

## 5.7 Babylon JS



Figure 46: Babylon JS

Babylon.js [28] is a constant 3D motor utilizing a JavaScript library for showing 3D illustrations in an internet browser by means of HTML5. The source code is accessible on GitHub and disseminated under the Apache License 2.0.

Babylon.js, conveyed to you by the people at Microsoft, is an open source JavaScript structure through which you can manufacture and render 3D diversions inside a program, with the assistance of WebGL and HTML5. While drawing a straightforward 3D object in crude WebGL expects you to manage a gigantic measure of JavaScript code, Babylon.js gives you a chance to do something very similar with a negligible measure of code and low dimension of multifaceted nature.

Babylon.js can be expressed as "one more Three.js" because of its amazing highlights, which enable you to make nearly everything, running from completely intuitive 3D diversions to vivified logos, in your program. In spite of the fact that this JavaScript structure is right now on its beginning time, yet even it offers engineers a strong establishment for making highlight rich WebGL manifestations that can be utilized all over the place. Ideally, a great deal of new cool highlights will be included soon.

## 5.8 UniGLTF



Figure 47 : UniGLTF

glTF (GL Transmission Format) is a document group for 3D scenes and models utilizing the JSON [29] standard. It is depicted by its makers as the "JPEG of 3D." It is an API-impartial runtime resource conveyance design created by the Khronos Group [30] 3D Formats Working Group and declared at HTML5DevConf 2016. The goal is that glTF be a proficient, interoperable resource conveyance group that packs the measure of 3D scenes and limits runtime preparing by applications utilizing WebGL and different APIs. glTF additionally characterizes a typical distributing position for 3D content instruments and administrations.

glTF 2.0 was initially begun as glTF 1.0.1 (and later glTF 1.1) in June 2016 as a bug fix discharge to take care of corner cases found while building up the glTF validator. Concurrently, force developed around a Physically-Based Rendering (PBR) materials [31] augmentation proposition by Fraunhofer. Given the enthusiasm for PBR and an API-nonpartisan configuration, the glTF 1.1 exertion was extended to move toward becoming glTF 2.0 to incorporate the accompanying new major features:





## **Features**

PBR materials dependent on a metallic-harshness shading model. A specular-polish shading model is accessible as an expansion.

Scanty accessors and transform focuses for strategies, for example, facial activity.

Advancing a refreshed form of the glTF 1.0 paired glTF augmentation deeply particular.

Diagram changes and breaking changes for corner cases or execution, for example, supplanting top-level glTF object properties with clusters for quicker record-based access.

## **History**

On October 19, 2015 the glTF (GL Transmission format) was announced.

glTF 2.0 was published June 5, 2017 at the Web3D 2017 Conference.

## CHAPTER 6

### Model Output

Gathering all the output from this project, Describing all of them below:

Main Menu

Augmented Reality View

Normal Unity view (Without AR)

Virtual Reality View

First Person View

### 6.1 Main Menu

When the application starts, first there will be the logo of unity then the logo of the title of this project “Realview”. After that the main menu will take place. In the main menu screen, there will be logo of the project and there will be the menus for the buildings. Currently there are 3 buildings in this project. So, there are 3 different building images on the menu. By clicking any of the menu first the program will take the users into AR Scene where the camera will be start working.

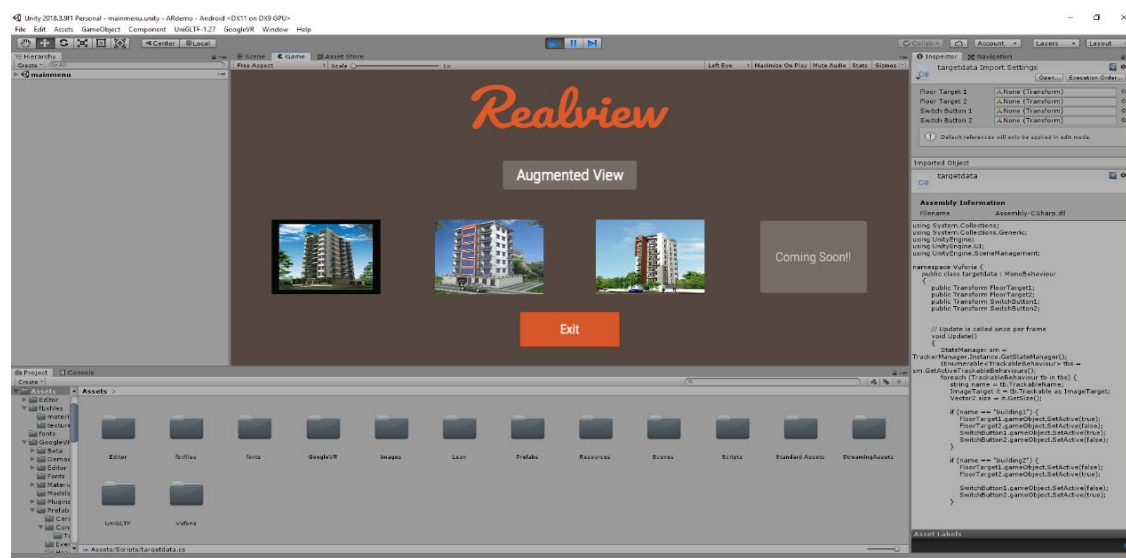


Figure 48 : RealView Main Menu

## 6.2 Augmented Reality View

From the main menu after clicking building image the AR Scene will be launched. After that the device camera will start working. When the user will place the camera on the tracker image, Exterior of the selected building will be shown on the screen. User can rotate the exterior of the building to have a 360-degree view of the full building. On the top side of the screen there is a menu bar to navigate the users. On the top right side there is a button called floor view. Clicking it the exterior model will change and the interior model will be shown on the screen. Where users can rotate, scale the model to see it from all angles. There is another button beside floor view which will take users to the normal unity view mode.

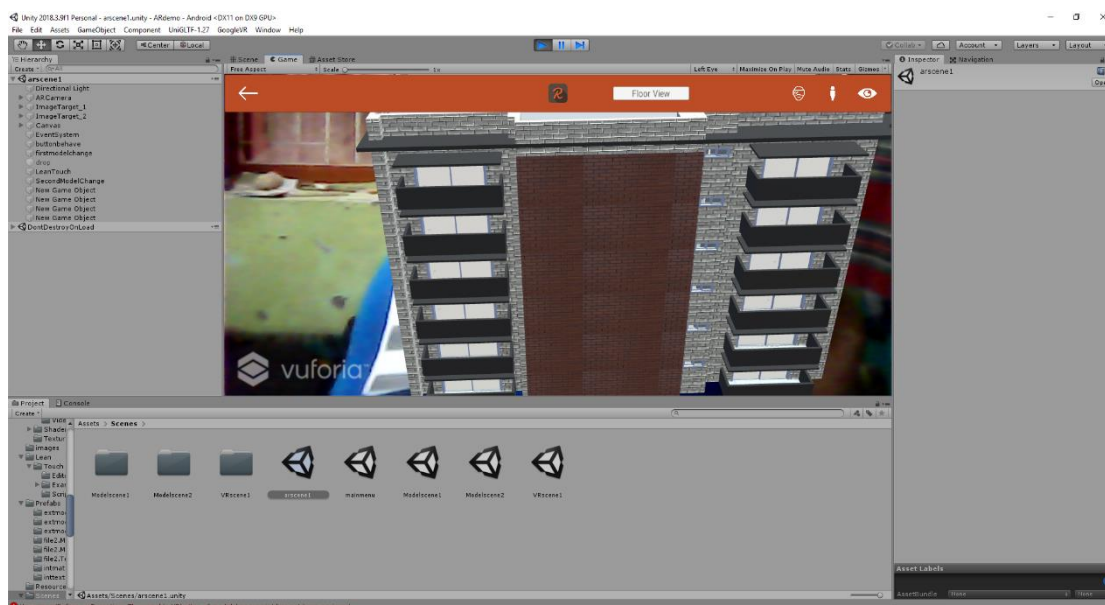


Figure 49 : Augmented reality view exterior model

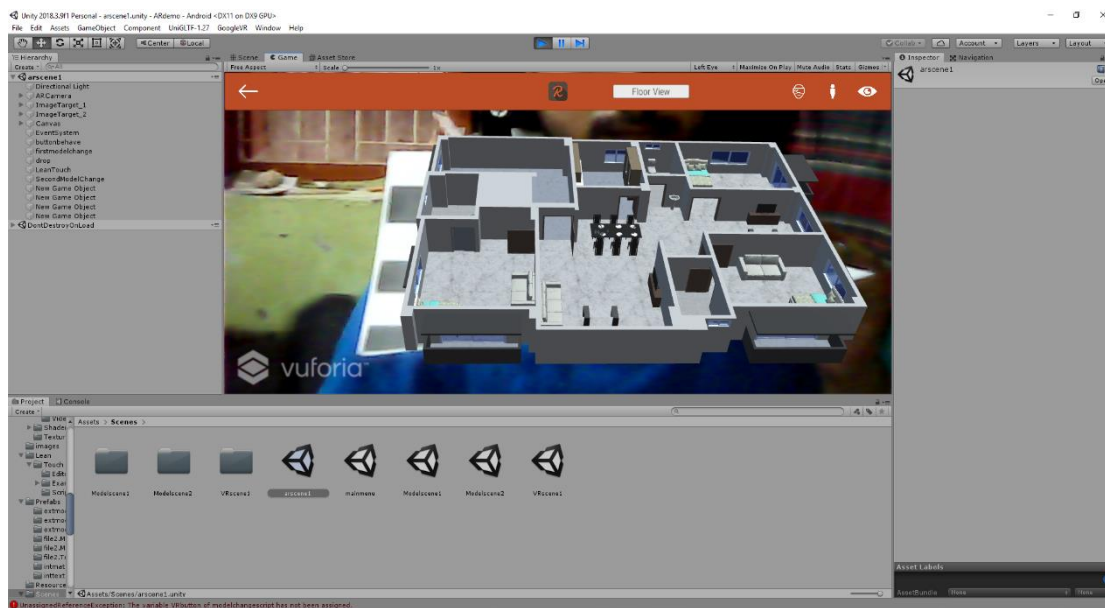


Figure 50 : Augmented reality view interior model

### 6.3 Normal Unity View (Without AR)

Sometimes the users can not have the tracker image along with them. For that reason, I also have given a normal unity view (Without AR). By clicking the normal unity view button, the normal unity screen will be launched and users can see the models without AR view. The Exterior view will be shown first then the interior view will be shown after clicking the floor view button. There are some buttons at the left side of the screen. They are called as navigation button for the screen. By clicking those buttons users can see specific part of the model they want. Like if any users want to see the kitchen specifically, when he/she clicks the kitchen view button the camera will be showing the kitchen specifically.

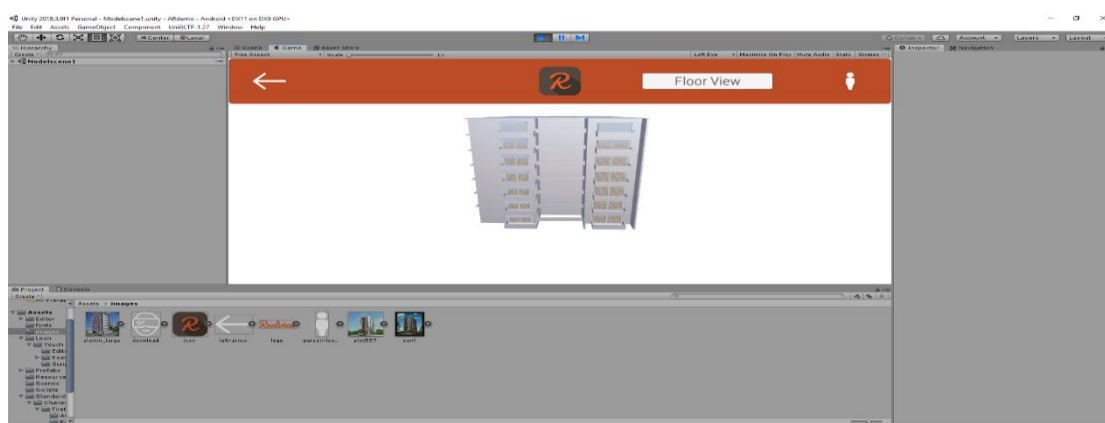


Figure 51: Normal View Exterior (Without AR)

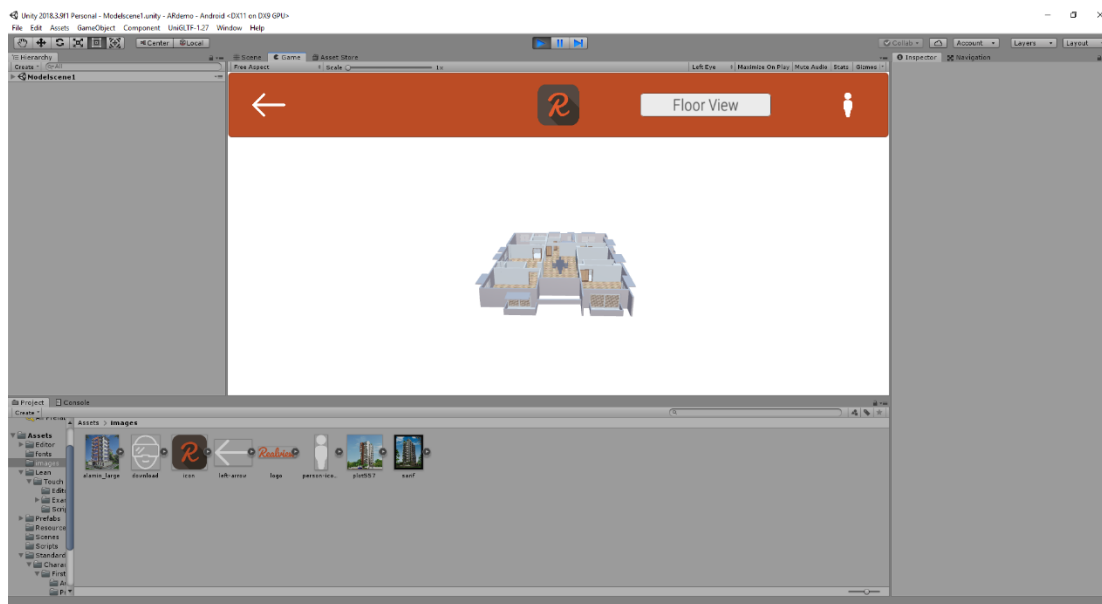


Figure 52 : Normal View interior (Without AR)

## 6.4 Virtual Reality View

If any users obtain a Virtual reality device and they want to experience the full virtual walkthrough then there is an option for them is called VR view. By clicking that the user will be taken to the virtual reality mode of the program in interior models.

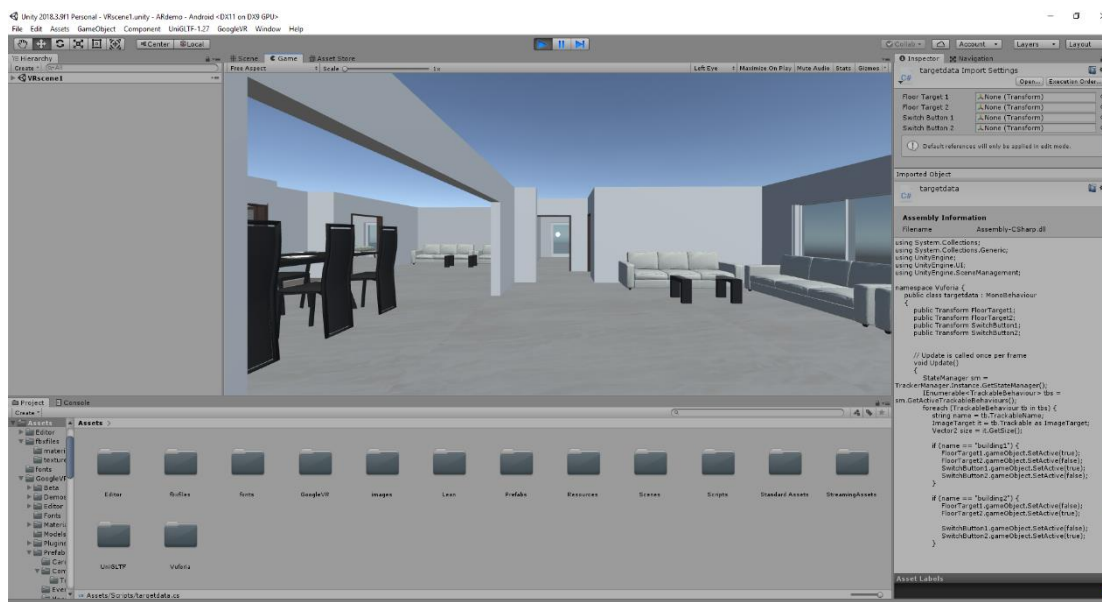


Figure 53 : Virtual Reality View

## 6.5 First person view

If any users do not have any virtual reality device, then there is an option for them to experience the models in first person view. Where users can move around the interior model by touching the screen of their mobile device.

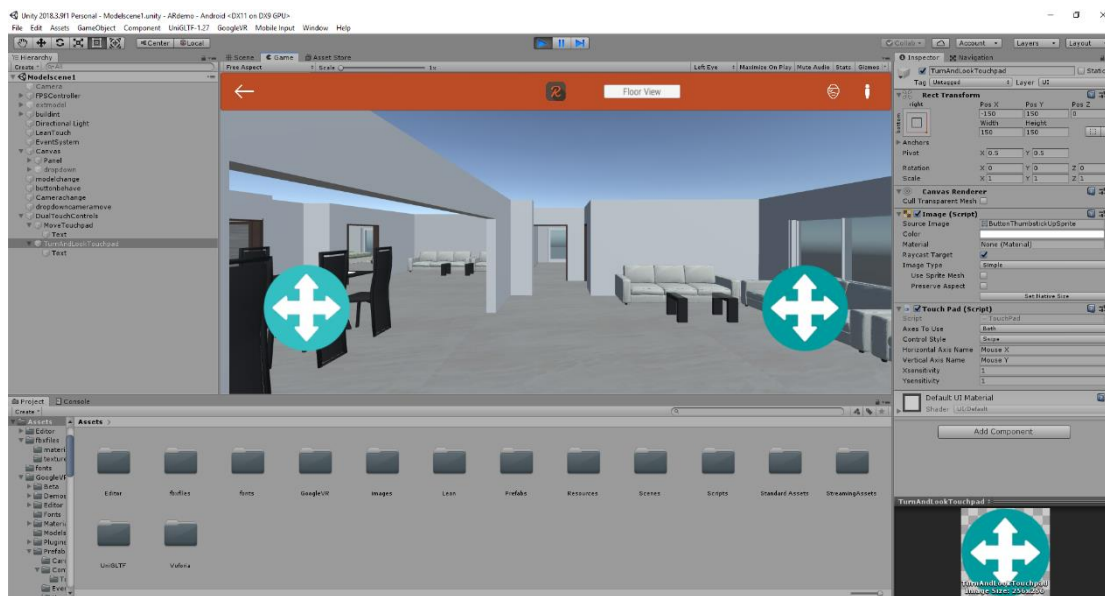


Figure 54: First Person View (FPS)



## CHAPTER 7

### PROBLEMS & SOLUTIONS BASED ON UX

While developing this project I have encountered many types of problems based on user experience and have found solution on that. I will discuss some significant problems that I have faced and solutions that I have found into this project.

Multi tracking model interaction

AR to VR conversion

Low Poly Model Extracting

Specific Room Section view

#### 7.1 Multi tracking model interaction

Firstly, I wanted to make individual AR scenes for individual models. Then I have realized that user may put the wrong tracker of have the wrong tracker. If user uses the wrong tracker for the wrong scene then ser will not get the building view and that will be a very bad user experience. That is why I used all the trackers into one AR scene that will contain all the models. If user puts any of the target images it will pop-up the specific model that is assigned to that target.

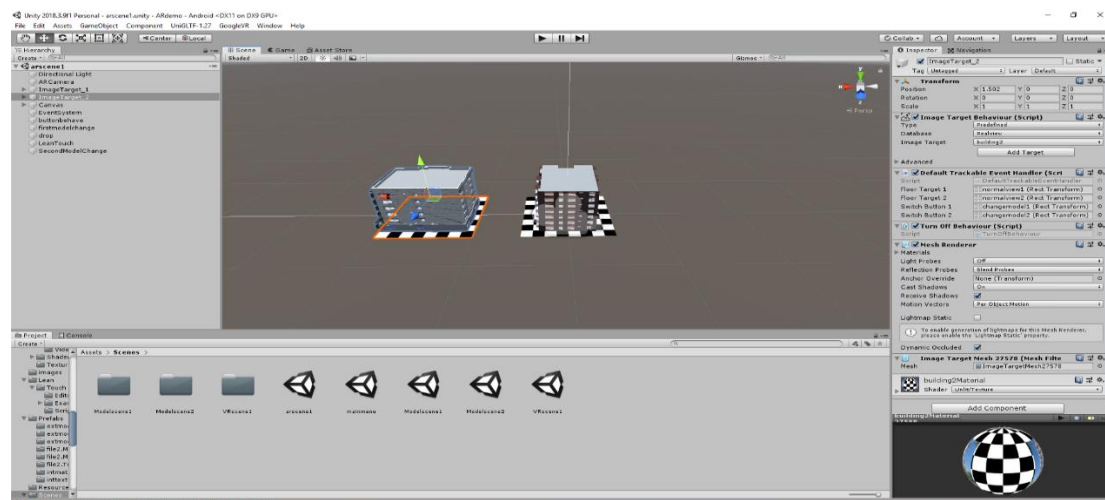
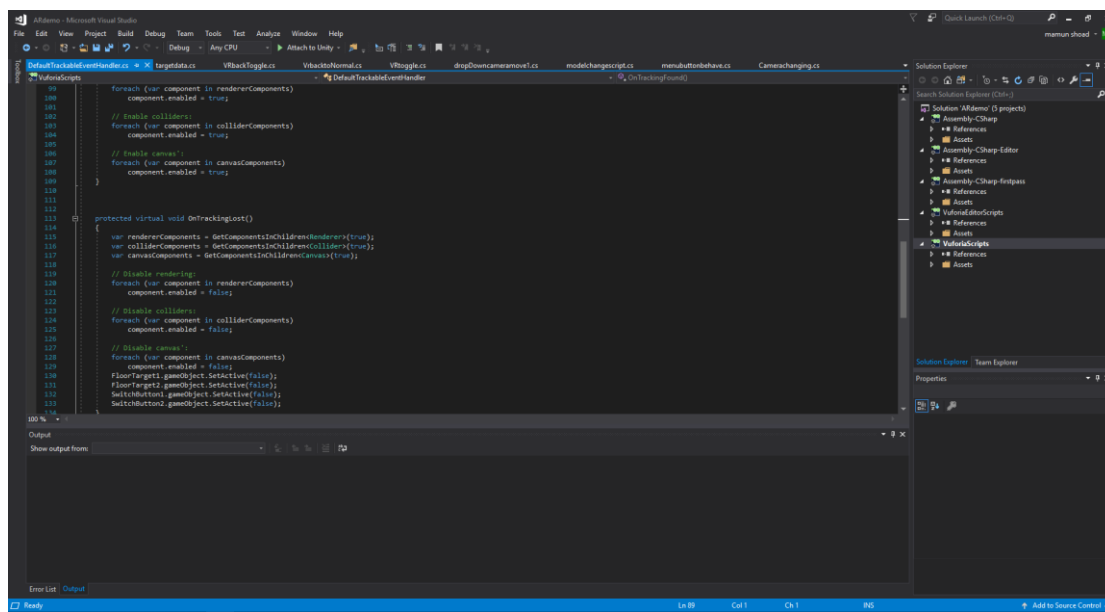


Figure 55 : Multi target images

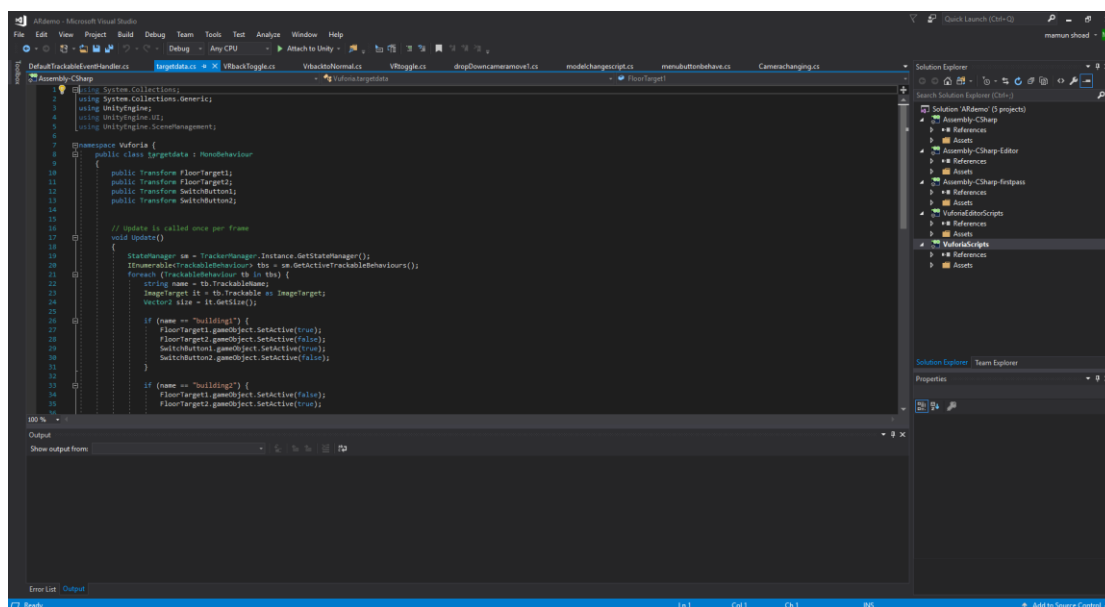
After putting all the target images into one AR scene I found out that I can move into only one specific model view from the AR scene. Then I have added some codes into Vuforia [10] core scripts that has come to me from the Vuforia SDK (Software Development Kit). Then I could go into any tracker-based model that I wanted.



```

99         foreach (var component in rendererComponents)
100             component.enabled = true;
101     }
102     // Enable colliders
103     foreach (var component in colliderComponents)
104         component.enabled = true;
105 }
106 // Enable canvas
107 foreach (var component in canvasComponents)
108     component.enabled = true;
109 }
110 }
111
112 protected virtual void OnTrackingLost()
113 {
114     var rendererComponents = GetComponentInChildren<Renderer>(true);
115     var colliderComponents = GetComponentInChildren<Collider>(true);
116     var canvasComponents = GetComponentInChildren<Canvas>(true);
117 }
118 // Disable rendering
119 foreach (var component in rendererComponents)
120     component.enabled = false;
121 }
122 // Disable colliders
123 foreach (var component in colliderComponents)
124     component.enabled = false;
125 }
126 // Disable canvas
127 foreach (var component in canvasComponents)
128     component.enabled = false;
129 }
130 FloorTarget1.gameObject.SetActive(false);
131 FloorTarget2.gameObject.SetActive(false);
132 SwitchButton1.gameObject.SetActive(false);
133 SwitchButton2.gameObject.SetActive(false);
134 }
135 }
    
```

Figure 56 : Vuforia core script tweaking



```

1  using System.Collections;
2  using System.Collections.Generic;
3  using UnityEngine;
4  using UnityEngine.UI;
5  using UnityEngine.SceneManagement;
6
7  namespace Vuforia {
8      public class TargetData : MonoBehaviour {
9
10         public Transform FloorTarget1;
11         public Transform FloorTarget2;
12         public Transform SwitchButton1;
13         public Transform SwitchButton2;
14     }
15
16     // Update is called once per frame
17     void Update()
18     {
19         StateManager sm = TrackerManager.Instance.GetStateManager();
20         if (sm.TrackerBehaviour == null) return;
21         foreach (TrackableBehaviour tb in sm) {
22             string name = tb.TrackerName;
23             ImageTarget it = tb.Tracker as ImageTarget;
24             Vector3 size = it.GetSize();
25
26             if (name == "Building1") {
27                 FloorTarget1.gameObject.SetActive(true);
28                 FloorTarget2.gameObject.SetActive(false);
29                 SwitchButton1.gameObject.SetActive(true);
30                 SwitchButton2.gameObject.SetActive(false);
31             }
32             if (name == "Building2") {
33                 FloorTarget1.gameObject.SetActive(false);
34                 FloorTarget2.gameObject.SetActive(true);
35             }
36         }
37     }
38 }
    
```

Figure 57 : Setting data target from Vuforia to another view



## 7.2 AR to VR Conversion

In unity when you activate virtual reality SDK, it will turn the whole application into virtual reality project and that was another biggest problem for me while I was developing this project. I found out the application I built for testing purpose it has changed into Virtual reality application. So, I removed the virtual reality scene and separated it to another scene. Then I wrote a script for Virtual reality that will only activate when the virtual reality button will be pressed and when user will want to exit the virtual reality mode the app will go back to normal 2d state.

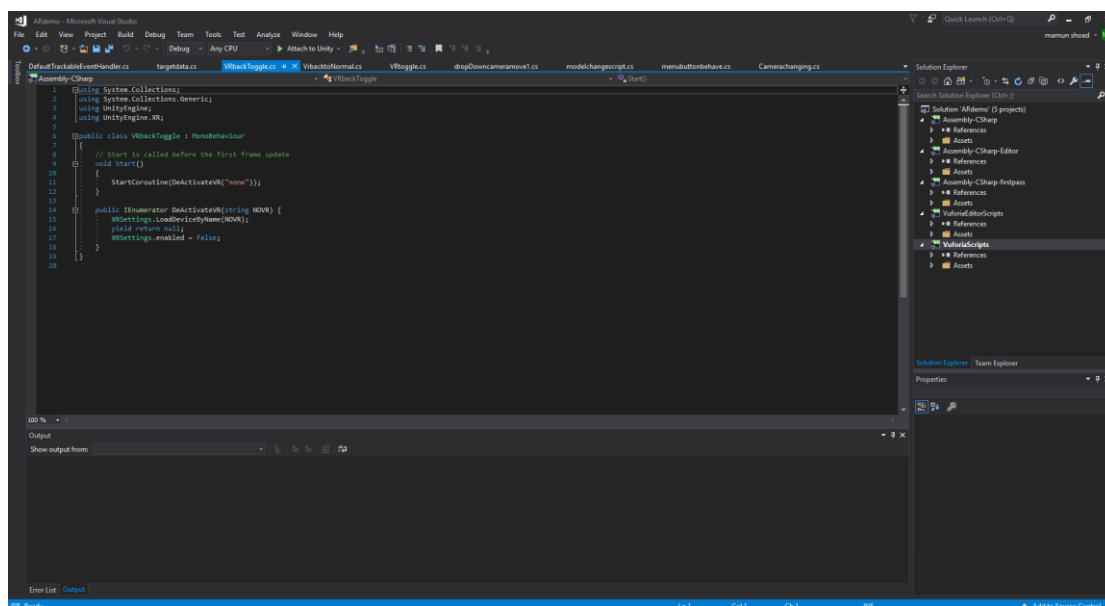


Figure 58 : VR to AR toggling method

## 7.3 Low poly model extracting

One of the biggest challenges was Extracting the models from 3ds Max to unity. During my research I found out some companies like Adobe, Sketchfab [32], Facebook [33] uses a method that converts the 3d models into JSON (JavaScript Object Notation) using glTF (GL Transmission Format) format. So, I researched about that and found plugins that will convert my 3d models into JSON format and I can import it into my Unity project. That was a very time-consuming process though but at the end of the day it was successful.

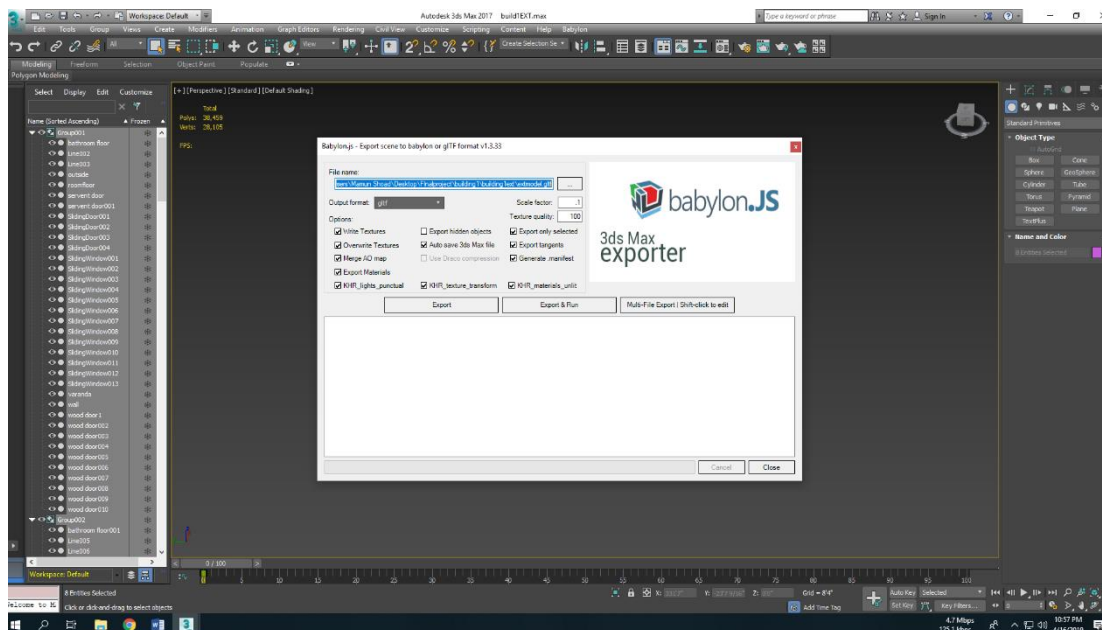


Figure 59 : Extracting model form 3Ds max using Babylon JS

## 7.4 Specific room section view

One day I was showing my project progress to my supervisor and while he was reviewing my beta application, he gave me a suggestion to make specific room view option. Because some user can ask for it. So, I created a dropdown using unity and pulled my main camera to specific room parts that I want to show the users. I transformed my main camera into specific positions to have a better look.

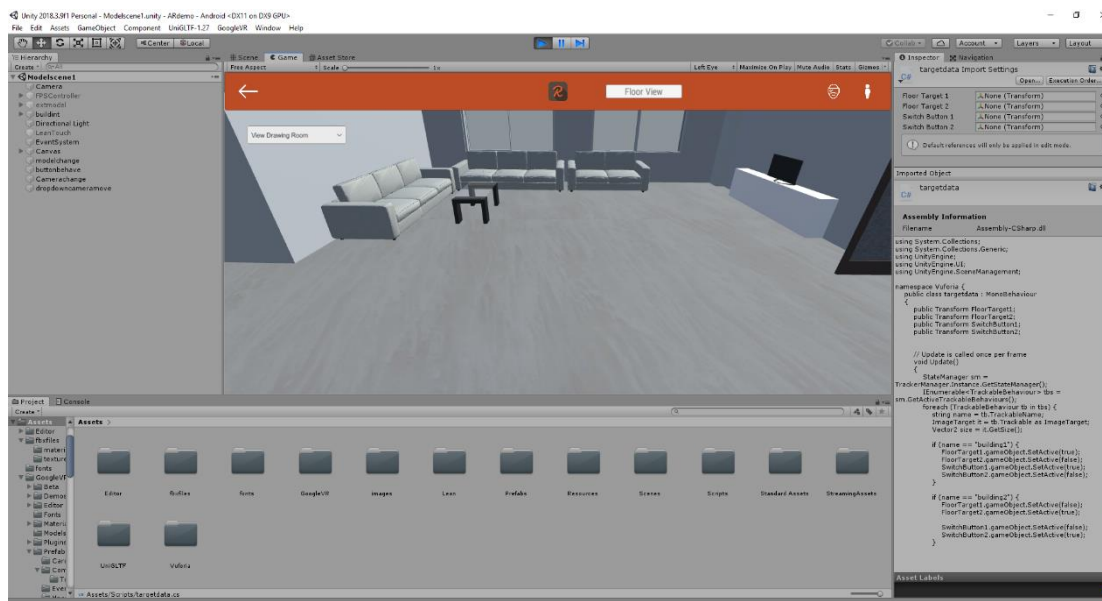


Figure 60: Dropdown drawing room view



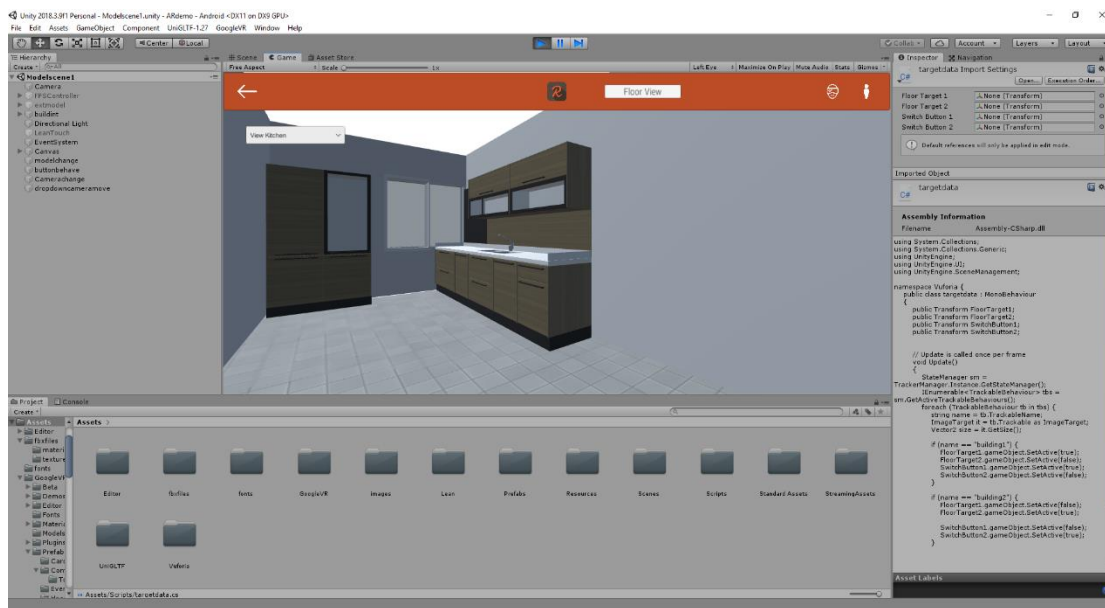


Figure 63 : Dropdown kitchen view

Except for those I created model switching script to switch the models in from a single button. I have given the users accessibility to rotate and scale the model if he/she wants.



## CHAPTER 8

### FUTURE UPDATES

Now let's talk about the future updates and functionalities that will be in this application.

#### **8.1 On Demand model download**

To reduce the core application size the future update of this application will contain a system that is called On Demand model download. By that user will get the core application and rest of the models will be in the server. When the application will start user will be prompt to ask if he/she wants to download the model. User can specifically download any model they want then they can view the model with image tracker or in normal AR mode as they want.

#### **8.2 Pipeline & Electric View**

Pipeline and Electrical wiring view are another type of view that can be used on architectural visualization. In future there will be option for viewing pipeline and wiring views in this application.



## CHAPTER 9

### CONCLUSION

Technology Evaluation as the project revolved around Autodesk 3ds Max and Unity it was necessary to learn. This created a large stress on the project initially which pushed it slightly behind schedule. This is to be expected with any new technology; however, talking on the REALVIEW project increased the risk with using new methods of exporting the models to unity. Creating models in 3ds max and Exporting them was a good learning experience.

Representation of various cameras, edges, surfaces and lighting makes a moment reaction environment; this decreases the time required to design key components however increases the requirement for experimentation. It ought to likewise be noticed that the 3d yield is exceptionally great for engineers with no past involvement in such an amazing situation.

Creating curved, rectangle, square model, Max seems a little out of its depth. Whilst it offers a coding environment to create animation it sometimes seems too heavy to handle even slightly complex tasks – especially making a model.

#### **What I have gained from this project:**

This project has enabled me to utilize new environments. Both environments are cutting edge and used in with my patients' level, so it was nice to get a taste of what i could enter into when i graduate. It would be good if more modules used newer technologies as it creates new challenges and allows the output to look a lot better. I am genuinely proud of what I have accomplished in both modules. The “Augmented Reality (AR)” and” Virtual Reality (VR)” was something completely new to me. I have done a short course about “Augmented Reality (AR)” and “Virtual Reality (VR)”and its requirements expandable enough so that, I could challenge myself and produce a really nice-looking mobile application with the combination of Augmented and virtual reality along with first person and normal 3d model view mode.



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