

RealTime Architectural Visualization (3d Modelling, Unwrapping & Texturing)

By

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This report presented the gratification that requirements for the
Degree of Bachelor of Science in Multimedia and Creative Technology

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DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

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APPROVAL

This Project titled “**Realtime Architectural Visualization (3d Modelling, Unwrapping & Texturing)**”, submitted by Tanjim Tarar Ahmed 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 1st October 2022.

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I hereby declare that, this project has been done by me under the supervision of **Mr. Kazi Jahid Hasan, Lecturer, Department of MCT, Daffodil International University.**

I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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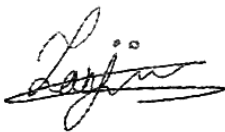
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Finally, I must acknowledge with due respect the constant support and patients of my parents.

Abstract

We have come a long way from living in caves to today's designed modern buildings. But the principles of visualization of architecture is still the same. Architectural visualization is a tool which is used to fill the gap between architects, clients and builders. If the communication between the client and architects is not clear and explicit it can be misinterpreted by the builders. Architects used to spend their valuable time creating presentations for the clients. But thanks to modern technology that process is done by 3d artists.

Real state assets are not only something we buy or invest randomly. We save our hard earned money little by little to buy or create the dream house. By creating a 3d model of that dream house we can let the client see how their house/ asset will look like. This gives the client a sense of satisfaction and builds a trust towards the designers. Through this project clients will be able not only see their asset in three dimensions but also interact with it and change anything about it as they like. Interactive architectural visualization will change the future. With VR hitting the mainstream, designers will have the power of giving the clients a virtual tour of their buildings before even a single building permit is applied for in real life.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In the current era of development human kind is moving forward at a very fast rate. One of the reality bending development of our generation is 3d visualization of architecture. Architectural visualization simply refers to creating a three-dimensional models that allows the client to explore and visualize designs from any angle. These 3d models are usually very detailed. Clients can easily change materials, furniture, lighting etc. anything that is contributing to the construction of the realistic building.

The world is already moving towards meta verse which is solely based on 3d models. 3d visualization is the latest development towards architectural visualization. The main purpose of this project is to facilitate the understanding of a design of a building at an early stage and to establish a shared language between the architect's skill and the client's vision. Thanks to this process even those who doesn't have technical knowledge can easily grasp all the project choices through images and videos created with specific software and tools.

Three 3d visualizing software are developing day by day. Thanks to the developers we are able to visualize these architectural assets in real time and also in virtual reality. This project is developed to help the clients visualize their dream house in a very easy an optimized way. Another purpose of creating this project is to create platform where clients can see all the furniture, colour combinations and materials which will be used to decorate their house and edit those options. By adding this feature we can introduce a new market to the developer companies.

CHAPTER 2

CASE STUDY

2.1: CASE STUDY OVERVIEW

In today's era we are moving towards the metaverse where everything and everyone will socialize through real time and virtual reality. During the pandemic caused by Covid-19 almost everyone is preferring online business, education, remote job and what not. All the companies and organizations are also trying to move their business online. In this situation a lack of interactive architectural visualization is seen in the developer market of Bangladesh. People are showing less interest to buy plots or invest in real estate due to lack of interaction. From buying clothes to foods these days we can see any product and their information online before buying it. But when a person is willing to create a building or invest in real estate asset he has to wait for the whole process of building the asset to end to see his design in real life. There are options to visualize their dream asset in 3d but none of them are interactive in Bangladesh.

2.2: PROBLEM IDENTIFICATION

After the creator of Facebook Mark Zuckerberg announced that Facebook will be called meta and he will invest in metaverse almost every big corporation in the entire world is switching towards 3d visualization. This affected our 3d architectural visualization companies as well. The big firms are already doing researches on how to create interactive architectural visualization and optimize it. There are very few architectural visualization firms in Bangladesh that maintain an international standard. Even though they offer walkthroughs in their projects but they lack in the sector of interaction.

Without the proper interaction the gap between clients and designers are being half filled. Usually clients won't understand every aspects of the design that the designer is providing. With proper interaction the client will understand what the designer is providing and the client will also have the freedom to customize their dream house.

2.3: OBJECTIVES

Architectural visualization is an integral part of any architectural project as it offers many benefits that are indispensable to the success of a project. Our main goal was to create a bridge between designers and clients so that they can share a common language which both can understand and make changes to easily. Here are some more objectives which we are aiming to cover:

1. Visualize the plan before the work begins so that the engineers and investigators can have a clear idea of how the project will look like.
2. Making it easy to identify problems and make appropriate changes.
3. Making the presentation of the project more realistic and engaging.
4. Coming up with a cost-effective way of providing investors with design solutions that meet their specific needs.
5. Create an option to modify the project whenever and however the designers and clients want to.
6. Help the designers to experiment and propose different solutions quickly until they reach the most convincing solution.
7. Converting it into a marketing strategy to sell the design ideas in competitive and surprising way.
8. Simulate creativity and helping to visualize new ideas and functionalities.
9. Put the project in its real environment (photo inset), maybe visualize it in virtual reality, you can realistically evaluate the project even within the city limits
10. Avoid possible evaluation errors.
11. To improve the quality of the project and take more daring architectural choices.
12. Having the freedom to control every project detail.
13. Making project cleaner and more competitive.
14. Making meetings with clients more efficient.

2.4: RELATED WORKS AND RESEARCH

During the development of this project I had to research on the companies that offer similar services. There are many 3d visualization firms in Bangladesh but very few of them maintain an international standard. Among these companies Auleek and Roopokor are two of the companies I conducted my research on.

While conducting this research I have found out that these companies are offering projects which maintain international standard. Even though the quality of the projects are very good they only offer walkthroughs in their project. Their projects lack interaction. Due to the upcoming fourth industrial revolution people are getting used to testing any product before buying it. From clothing brands to automobile companies turning their products in 3d models and uploading them instead of simple and boring 2d images. These companies are also unable to give their clients the freedom to make significant changes to their dream assets.

Viz4d is also an architecture render firm which created an online realtime visualization platform. It offers interaction with their assets but the user can't change any of it.

2.5 COMPETITIVE ANALYSIS

For a business to grow one must always be aware of his competitors. For this reason while conducting my research on other architectural visualization companies I saw That they lack optimization and they can not offer the interaction we are currently giving and hoping to give. This project is not only beneficial for the clients but also for other companies which are related to architectural development.

We will provide a catalog which will contain all the products one will use in their house. They can chose from a wide range of choices what the would like to implement on their design. If they decide to change any object at anytime we will be able to change it in 3d software. This is the unique selling point of my project.

2.6: HYPOTHESIS OF SOLUTION

The solution I have come up with the help of this project for sure will increase the interaction with the project. The main goal is to create an application which will help the clients to roam around in their building in 3d without going anywhere. But due to the lack of programmer in our team we could not develop an app but came up with an alternative of our final view.

If we can establish a firm with the requirements we and by following this pipeline we can contribute to the architectural visualization industry.

CHAPTER 3

USER RESEARCH

3.1: USER RESEARCH

While developing this project my first concern was to make it user friendly. I tried to increase interaction as much as possible. This project is created based on a vacation home. So I had to research on what does a client wants from a vacation house and then include those attributes to the project.

I researched on what and how the clients want their projects to be done and also contacted with some developer companies so that they can tell me what problems do they face while handling a client. I took a survey on someone who is going to invest on building a vacation home. From him I came to know what client is looking forward before investing in a real state asset. How they can describe their requirements to the architects and designers.

3.2: TARGET USERS

Today we can classify the market for 3d rendering and visualization in many sectors. According to Easy Render [5] we can classify the target users into given segments:

1. Both enterprise and end-users.
2. Technology providers.
3. Contractors, distributors and suppliers.
4. Venture capitalists.
5. Investors.
6. Application service providers.
7. Consulting companies.
8. Third-party vendors.
9. CGI developers.

10. System integrators.

11. 3d rendering and visualization solution vendors.

12. Film and documentary making companies.

3.3: USER ANALYSIS

In terms of end use, the real estate segment holds the top share in the visualization and 3D rendering industry. The market within this segment is fueled by the growing demand for visualization and 3D rendering tools from architects and real estate professionals to remotely showcase properties or provide them to potential clients under construction. We also provide layout ideas for properties. The increasing popularity of virtual property tours, especially amid the 2020 COVID-19 pandemic, has further contributed to the growth of the market. According to Expert Market Research [6] market share by users is:

Global Visualisation and 3D Rendering Market

Market Share by End Use(%)

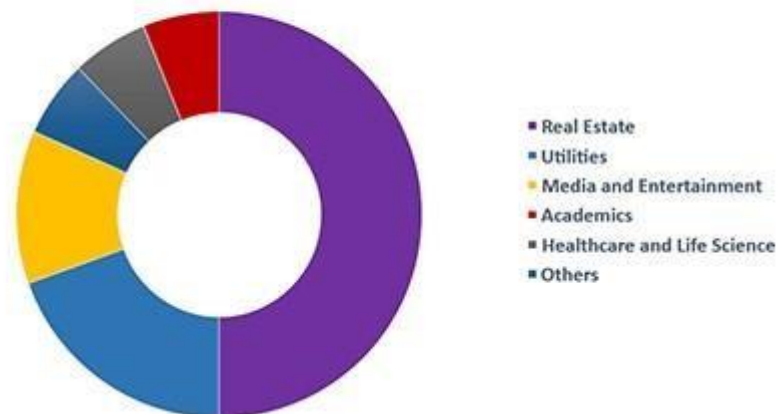


Figure 3.3.1 Market share by end user (%)

Not only globally but also in Bangladesh real state is the biggest user of 3d visualization and rendering. For this reason I targeted the real state market.

CHAPTER 4

WORKFLOW

4.1: WORKFLOW

Creating a workflow before getting to it made the whole process a lot easier. I divided the whole process into different tasks and set it up in a numeric manner. This allowed me to work on this project smoothly. One of the biggest positive impact of creating a workflow beforehand is that I was able to get feedback from the my team member and my supervisor after finishing every single task.

The workflow I maintained is mentioned below:

1. Concept making.
2. Blueprint design (Preliminary design & detailed drawing)
3. Modeling in 3ds max
4. Asset Production
5. Asset Finalizing
6. Delivering the assets

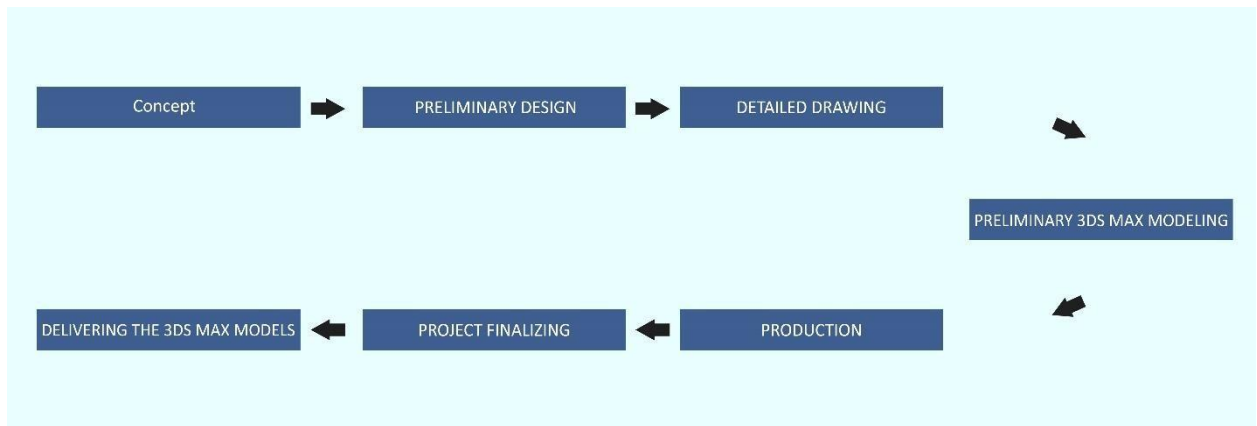


Figure 4.1.1 Workflow

Creating the gantt chart is also an important step. Setting up a timeline helps to complete that tasks in due time. This also helps to clear up some errors or make some changes to the design . The gantt chart of this project is given below.

Gantt chart:



Figure 4.1.2 Gantt chart

4.1.1 List of software

Adobe illustrator [13] is an industry standard software which is used to create illustrations of any kind. It is a strong software and is capable of producing topnotch outputs.



Figure 4.1.1.1 Adobe Illustrator

Adobe photoshop [14] is specified in image manipulation, colour correction and create texture. I used this software to create some of the textures in this project.



Figure 4.1.1.2 Adobe Photoshop

Autocad [15] is a software created by Autodesk. This is mainly used to create blueprints. I used this software to create the blue print of the house.



Figure 4.1.1.3 Autodesk Autocad

3ds max [16] is also created by Autodesk. This the industry standard software to create 3d models for architectural visualization.



Figure 4.1.1.4 Autodesk 3ds max

Rizom uv [17] is a software which helps to create clean and optimized UV maps for 3d models. It is very fast and easy to use, The navigation system can be set according to the software I am using to create the 3d mesh.



Figure 4.1.1.5 Rizom UV

Substance 3d painter [18] is the industry standard software to create materials for 3d models. It has a huge set of options to create any type of material.



Figure 4.1.1.6 Substance 3d painter

4.2: CONCEPT

The first task at hand was to finalize a concept on which I will work on. The project I was trying to build is a vacation home. So I had to keep in mind that the client of this project will use this home very rarely. Everyone will come here to stay for a very short time but a very peaceful one. Keeping that in mind I consulted with an architect to know what are the attributes that a person is looking for in a vacation home.

To come up with a concept I had to look up some references. The references I used to build this project are given below:

Black Rock, VIC, AU, Rentals [8]



Figure 4.2.1 BlackRock, VIC, AU, Rentals

Israel, a luxurious modern villa [10]



Figure 4.2.2 ISRAEL: A luxurious modern villa The Stinson Beach House [7]



Figure 4.2.3 Stinson Beach House / WA Design Inc Coastal Residence/ Bora Architects [11]



Figure 4.2.4 Coastal Residence / Bora Architects

So, while finalizing the concept of my project I focused on keeping it away from the busy city and closer to the nature. The design of the house is very open with big huge balconies and veranda. The location of the building is thought very carefully so that it does not get very hot and wind can pass through very easily.

After finalizing the concept of the exterior I researched on interior design. In this step I looked up some references again.

The references that were used to design the interior:

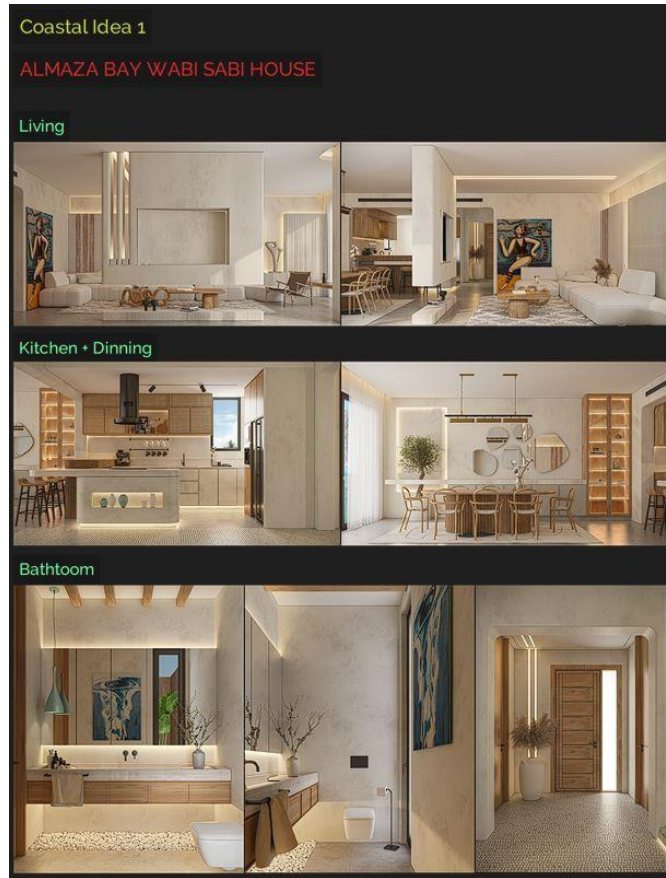


Figure 4.2.5 ALMAZA BAY SABI HOUSE

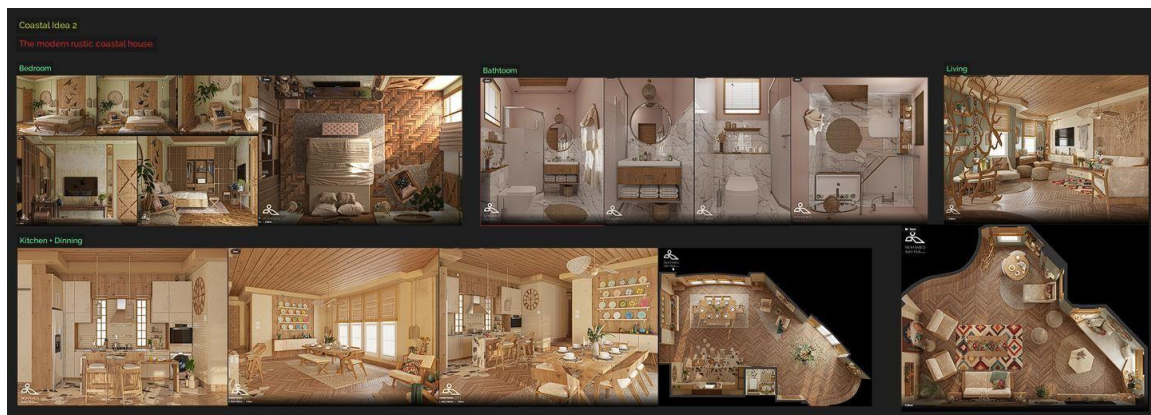


Figure 4.2.6 Modern rustic coastal house

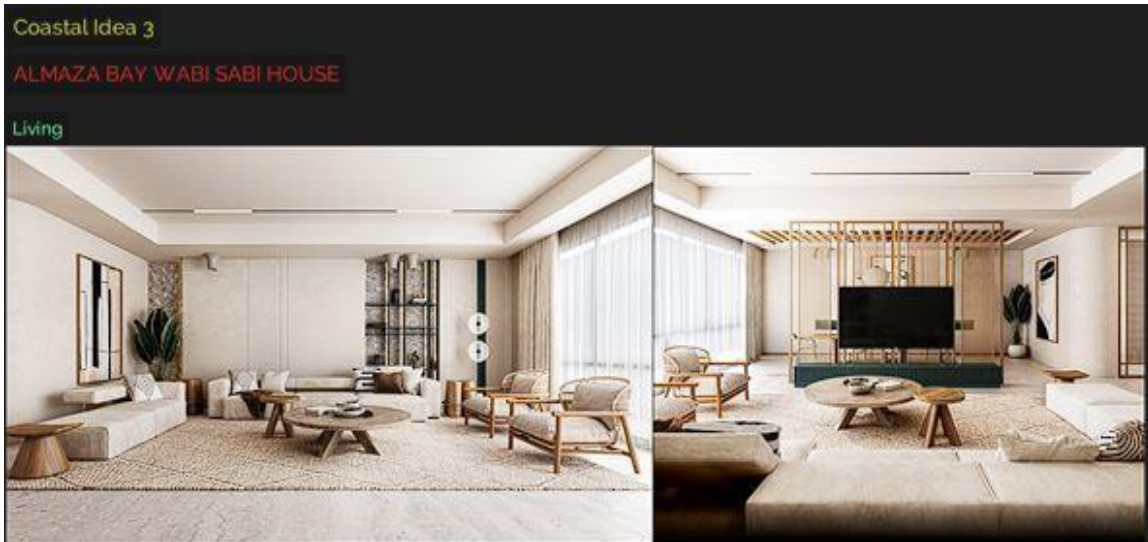


Figure 4.2.7 ALMAZA BAY WABI SABI HOUSE

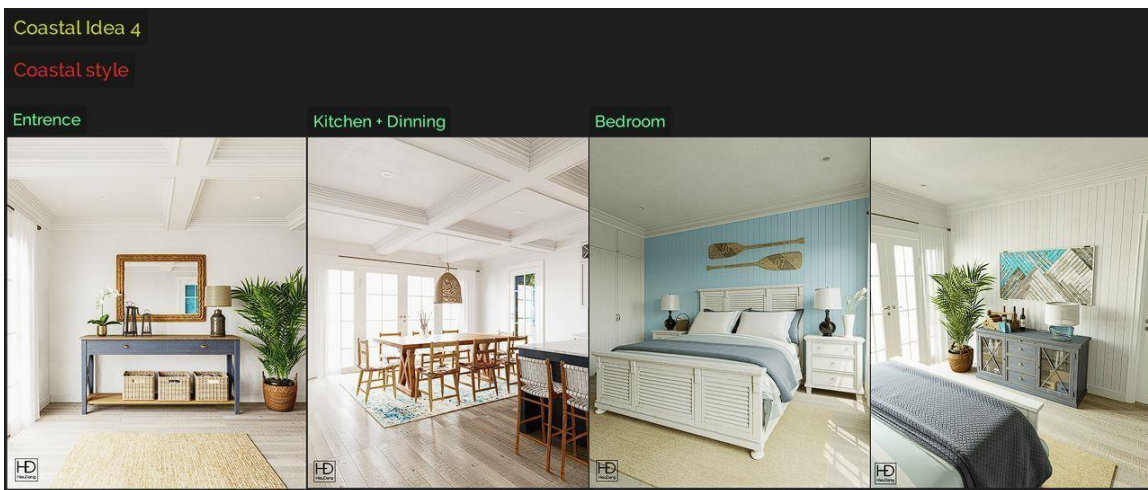


Figure 4.2.8 Coastal style house

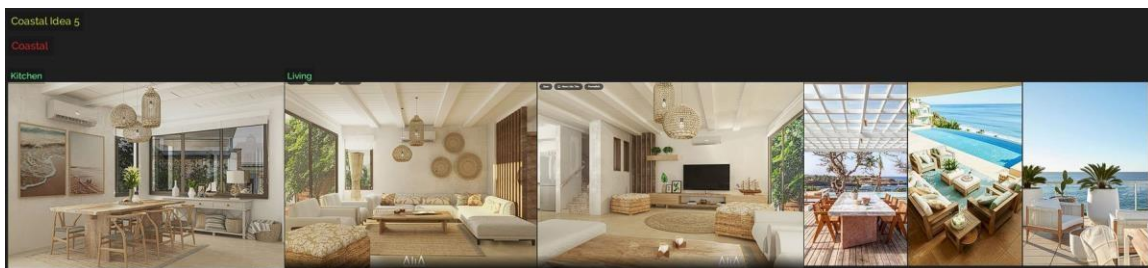


Figure 4.2.9 Coastal penthouse1

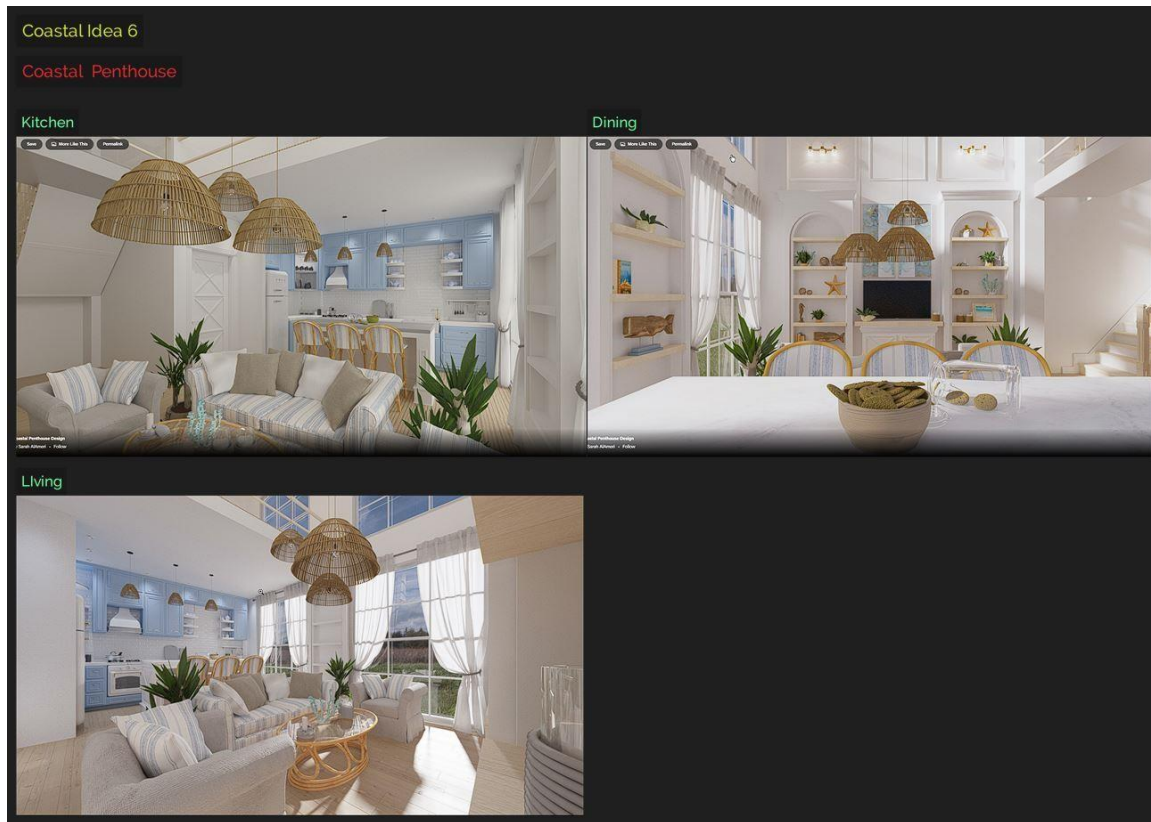


Figure 4.2.10 Coastal penthouse2

4.3: BLUEPRINT DESIGN

Using the references and our purpose of creating this project I finalized a concept and drew out a rough sketch.

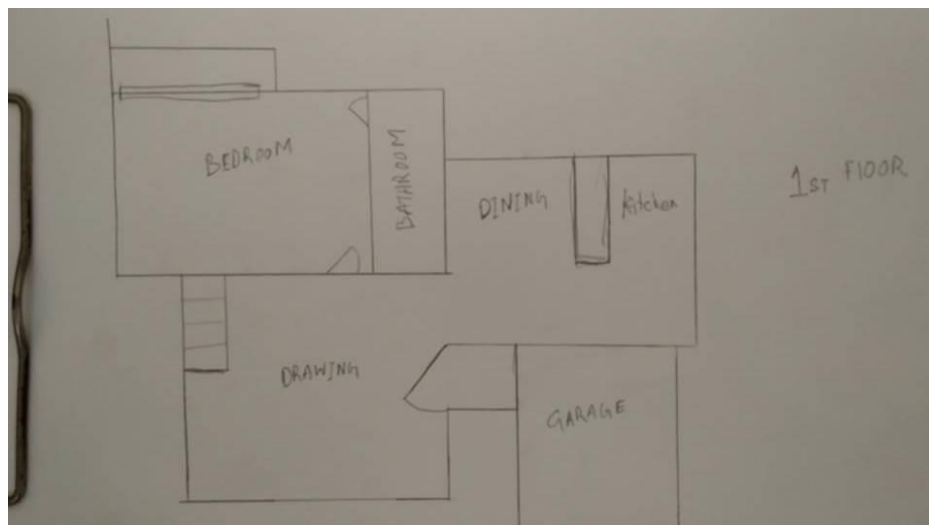


Figure 4.3.1 Rough sketch of the floor plan

After creating the rough sketch I took it in adobe illustrator to create an preliminary illustration of the building.

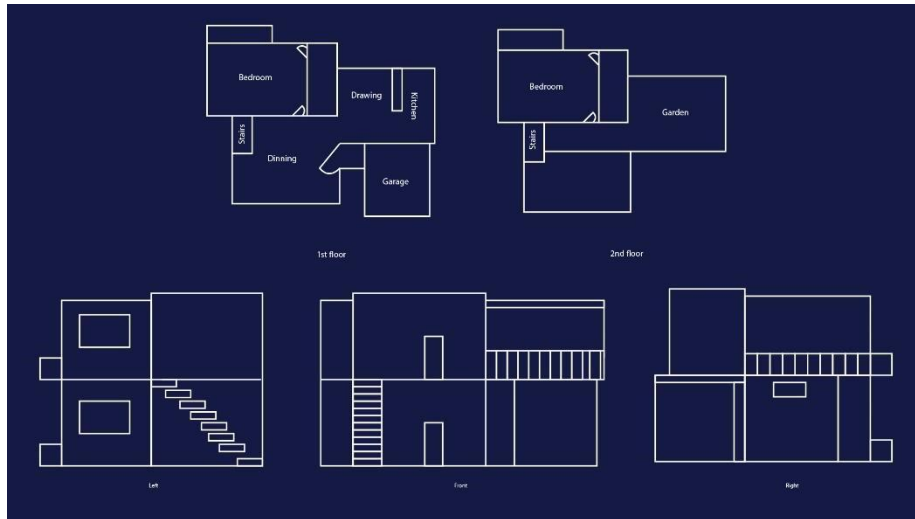


Figure 4.3.2 Illustration of the floor plan

The preliminary design was created in Adobe Illustrator. I drew blueprint of the house from four different angles which are front, back, right and left.

I consulted with an architect with these designs and got some pointers and very valuable information. I noted down those pointers and made significant changes to the drawing.

After creating this rough I took to an architect to get his opinion on it. He evaluated my design and pointed out the mistakes of the design and gave pointers to how I can resolve them.

After finalizing the drawing It was time to create a blueprint on Autocad. Autocad is a software where all kinds of blueprints are made. It is specialized in that sector. Also being a software of Autodesk it is very easy to export and import files in 3ds max which used to model all of the project in.

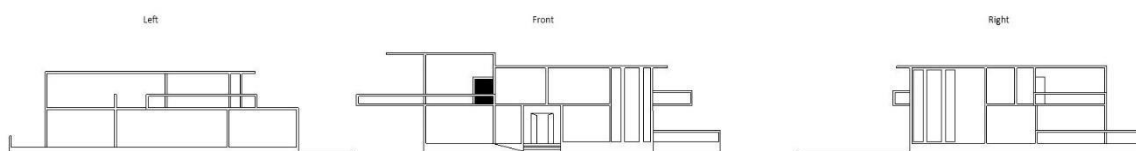


Figure 4.3.3 Autocad design side profiles

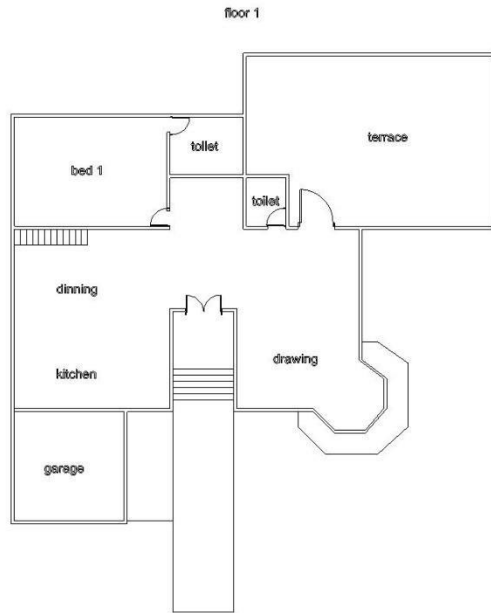


Figure 4.3.4 Autocad design floor 1

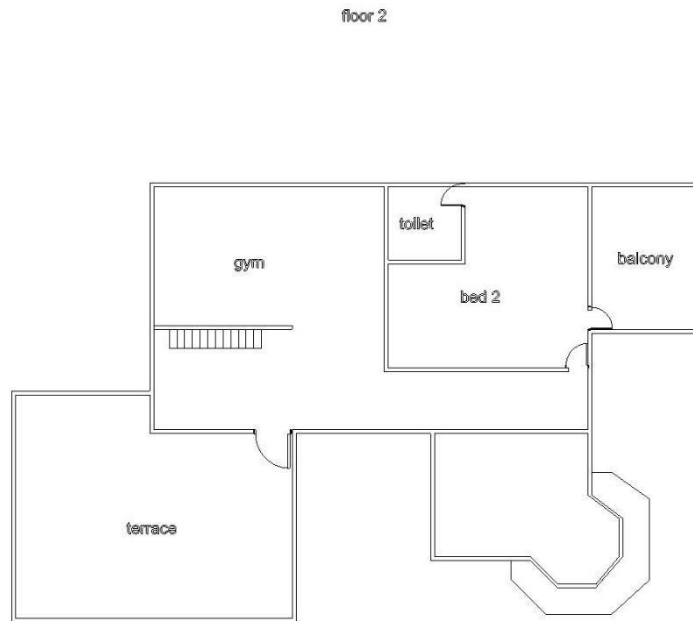


Figure 4.3.5 Autocad design floor 2

In Autodesk I created the design with proper measurements. The total area of this project is built on 20,394.74 square feet. The house is built on 3814 square feet. It is a duplex building with modern design.

The final design:

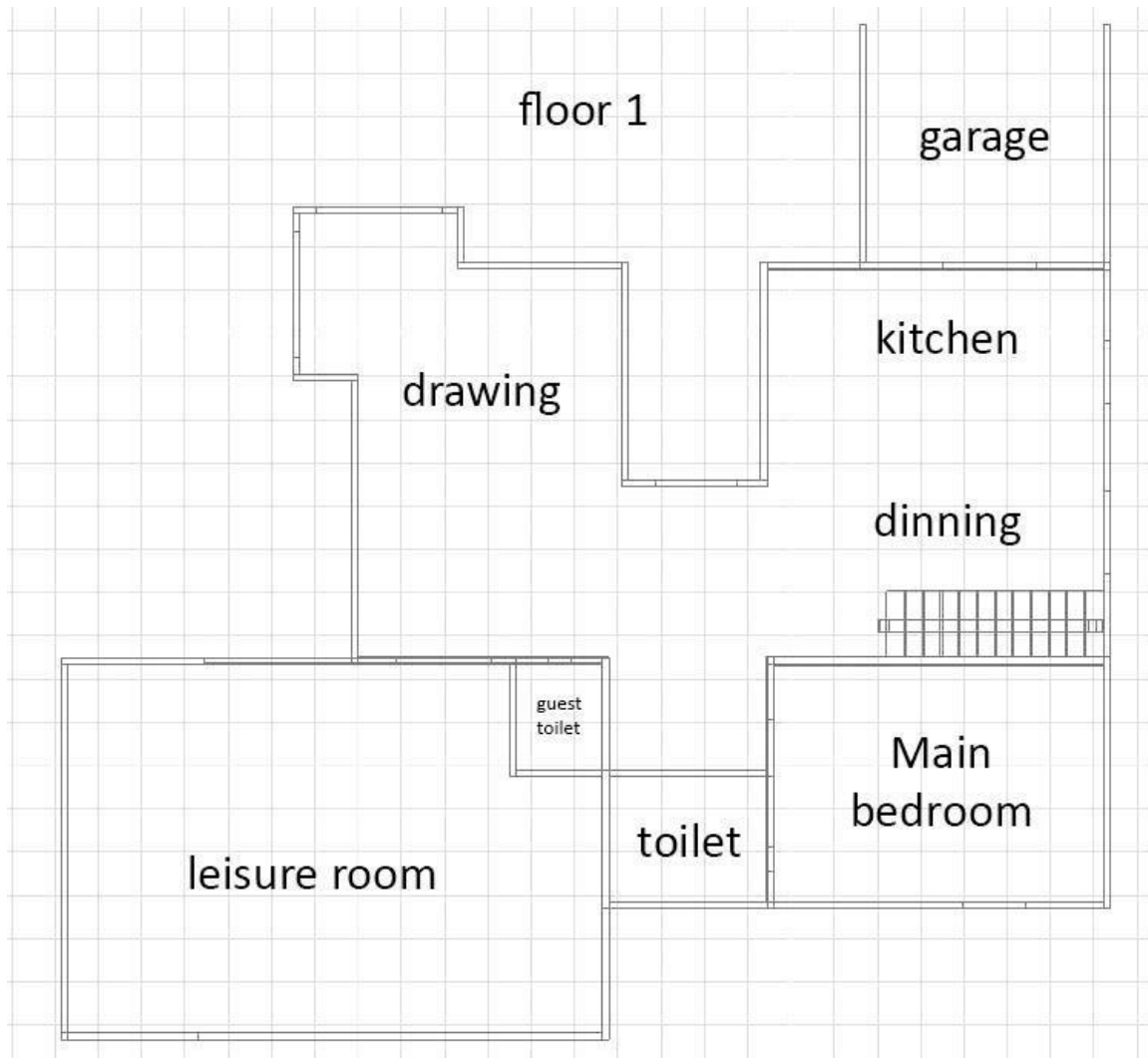


Figure 4.3.6 Final design floor 1

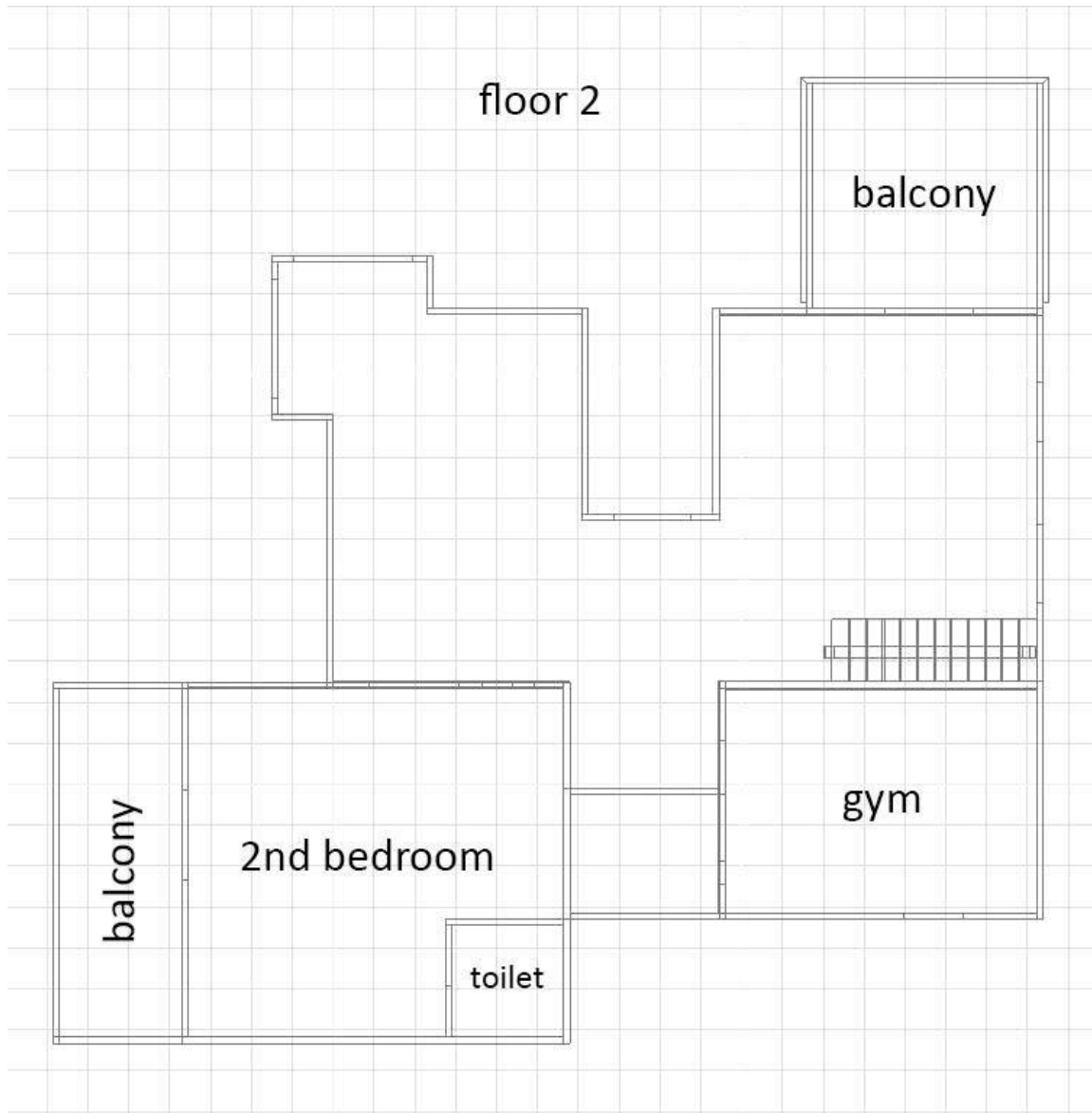


Figure 4.3.7 Final design floor 2

The design of the house was created keeping the purpose on mind. It is a vacation luxurious home. Even though the bedrooms are quite spacious but compared to the balconies and leisure rooms they are small. It is a vacation home. Residents of this home will visit this place enjoy the view from this place and get a little closer to the nature. Spacious balcony, huge windows and open verandas will provide everything the residents will expect from this place.

The kitchen of the house is situated in the east. The leisure room and drawing room/living room is situated in the west. The reason behind this is that the residents will spend a very small time in the kitchen and most of the time in other mentioned rooms. Sun light enters the room from the east

and the temperature from that light is felt in that direction. Because it is vacation home and the residents will spend most of their time in the living room and leisure room it is situated in the opposite direction. The temperature of the environment in Bangladesh is pretty high. Keeping the rooms cool which will be used more often was one of the primary conditions.

This project has garage which can keep two cars at a time. The area of the garage is 324 square feet. It has also room for keep accessories to work on the cars. The house has a patio and a swimming pool as well. The swimming pool is on the west side of the building which will hide it from the direct sun light when the temperature is the highest. Bu the area where the resident can sit beside the swimming pool has direct sunlight.

The patio is right beside the swimming pool. The patio is right beside the swimming pool. The structure of it was designed based on wood. The patio is also on the east side to avoid heat from the direct sunlight.

4.4: PRELIMINARY 3DS MAX MODELING

In this stage I imported the blueprint created in autocad in 3ds max. 3ds max and autocad are both software developed by Autodesk. For his reason this process is very easy and helps to work very fast and create clean meshes.

I used the box modeling method to create the walls of the building. Turning on the snap tool helps to create meshes along vertexes. This helps to create models with accurate measurements. Using box object from standard primitives I created the walls of the building. The thickness of the walls is 3 inches. The height of the doorway is 7 feet. The entire building is 3.5 feet above the ground.

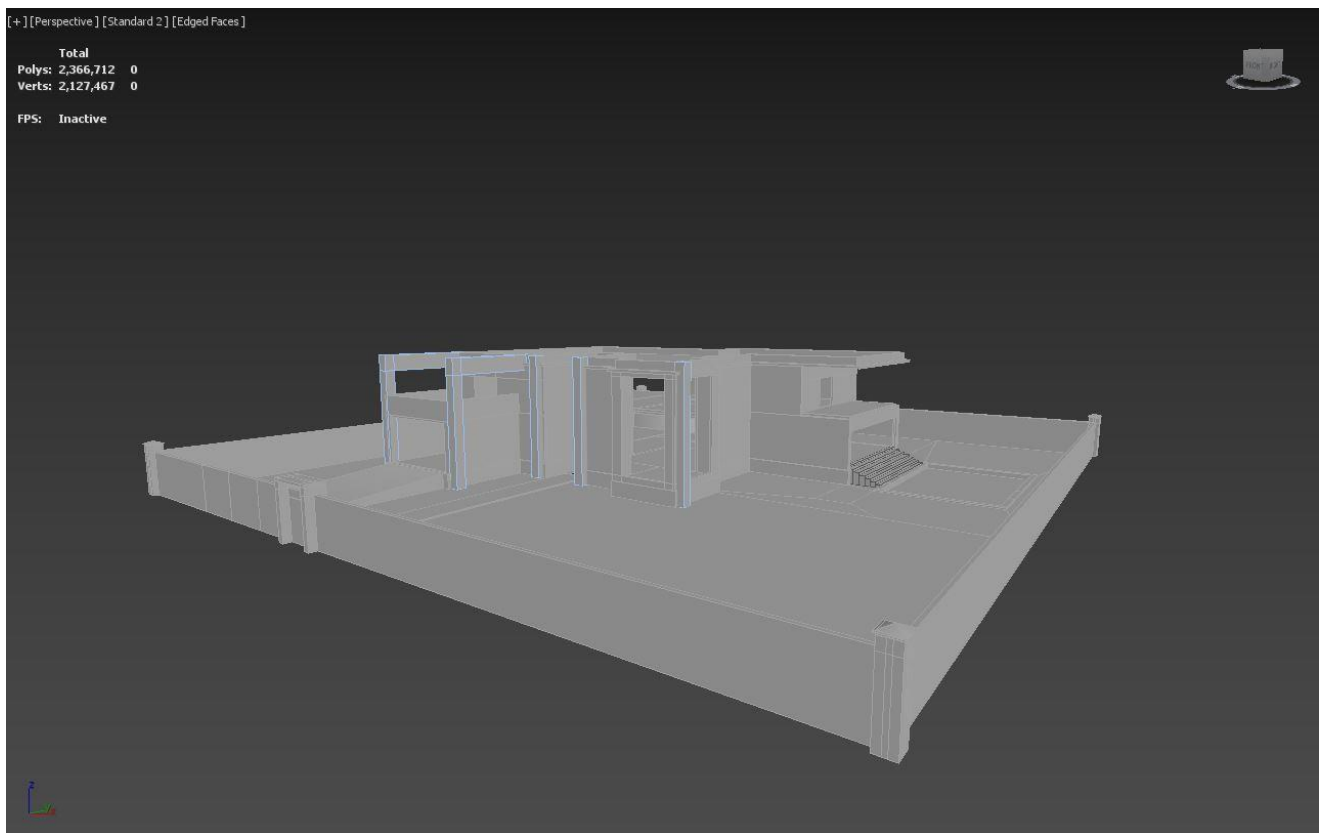


Figure 4.4.1 Exterior modelling 01

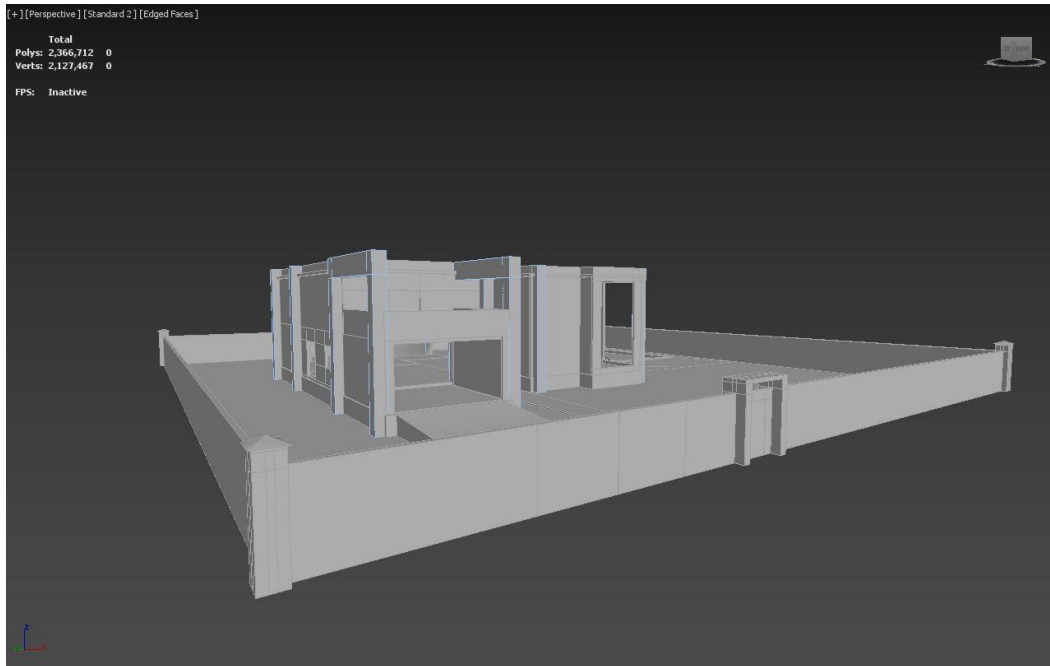


Figure 4.4.2 Exterior modelling 02

Then I started to model the walls of the interior. This house has two bed rooms, kitchen, dining space, 3 toilets, living room, leisure room, gym, a veranda and a balcony. The two bedrooms have attached bathrooms.

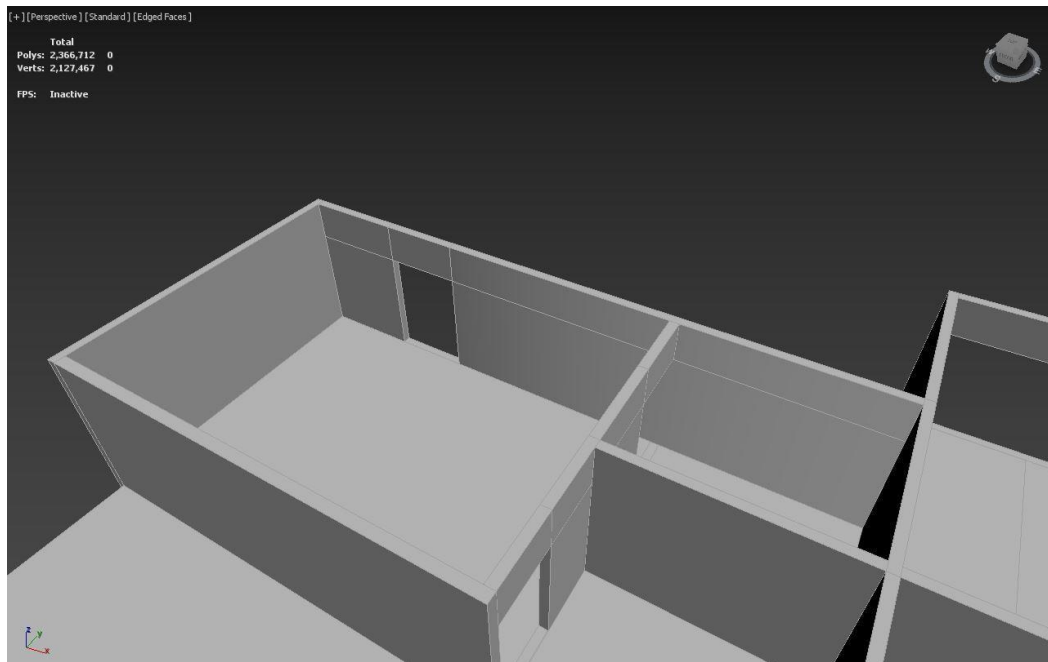


Figure 4.4.3 Main Bedroom walls

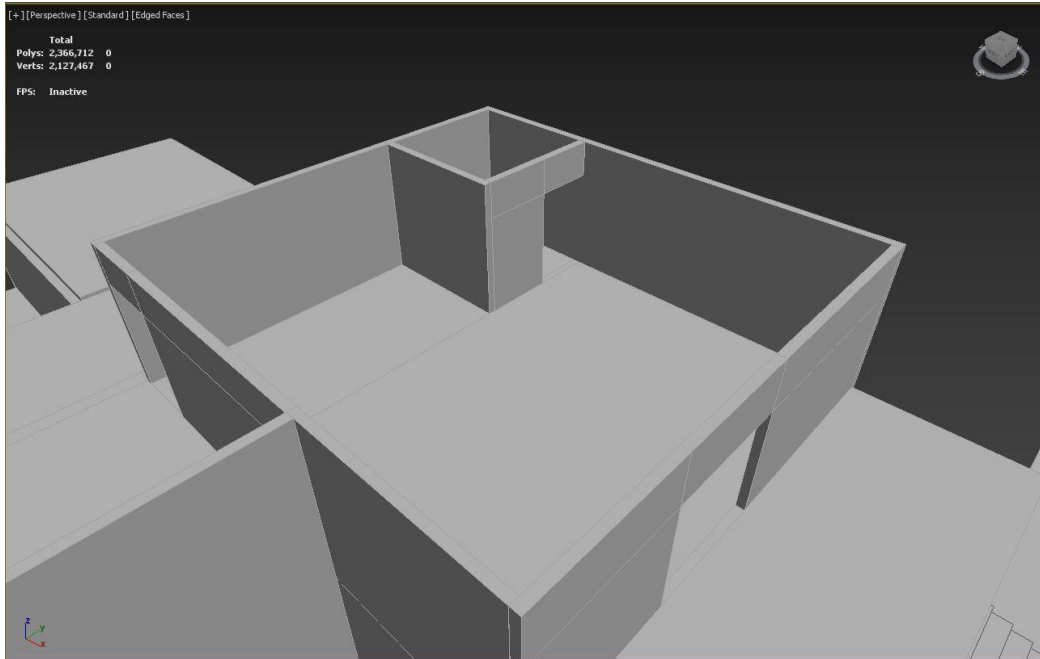


Figure 4.4.4 Guest bedroom walls

The kitchen and the dining space is joined together. It is very spacious and direct sun light and air can enter easily.

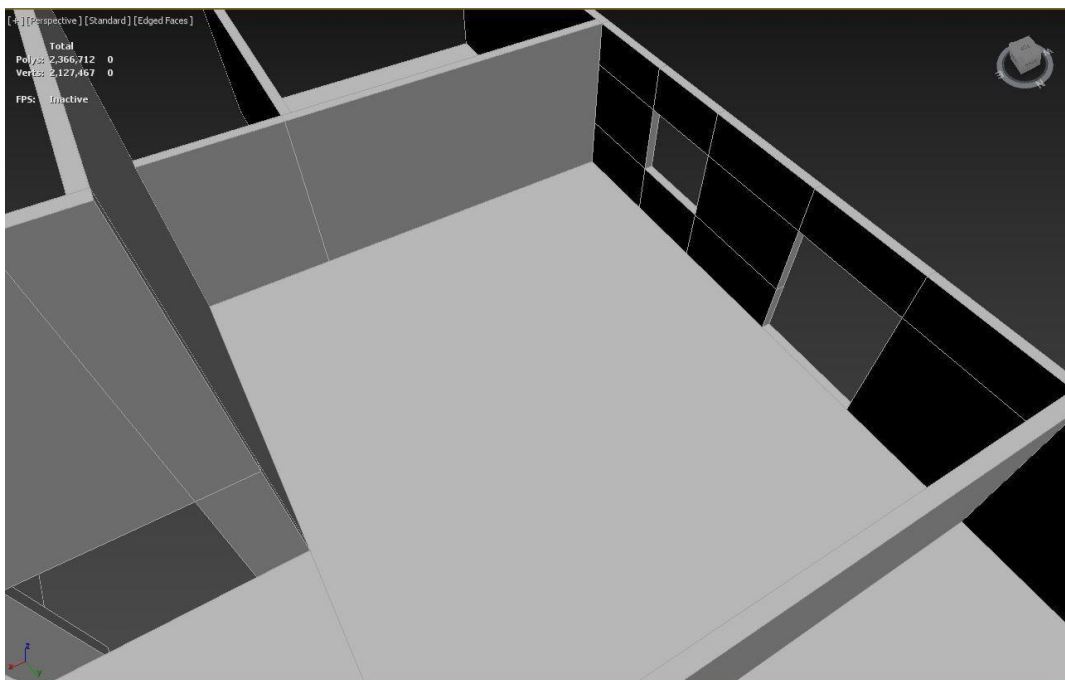


Figure 4.4.5 Kitchen & dining room walls

The living room is one the unique attraction of the house. It is created by combining both first and second floor. It has two large windows and enough space for all the necessary furniture.

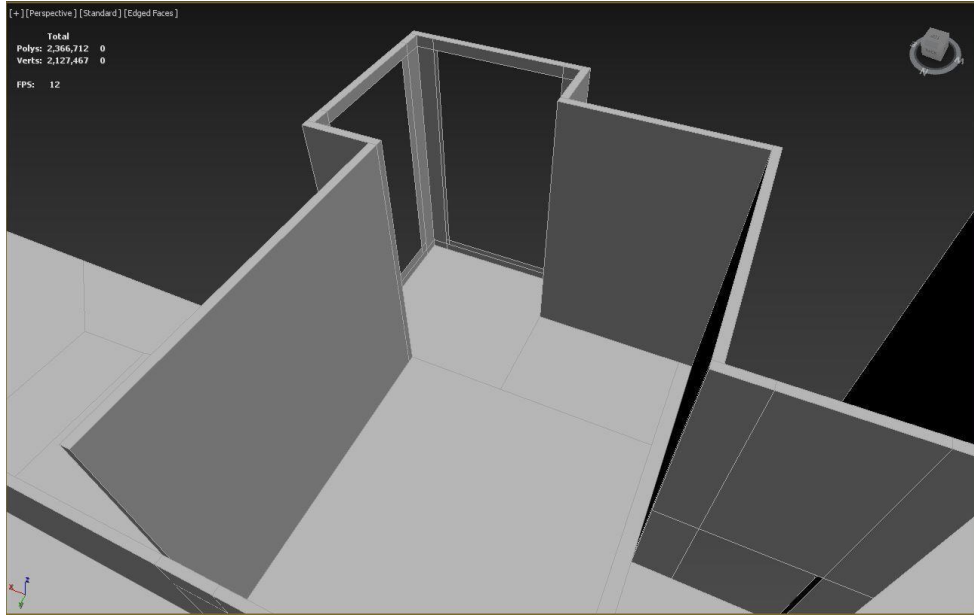


Figure 4.4.6 Living room walls

The other rooms are also made with huge spaces and big windows so the residents of this place can enjoy the view of the nature.

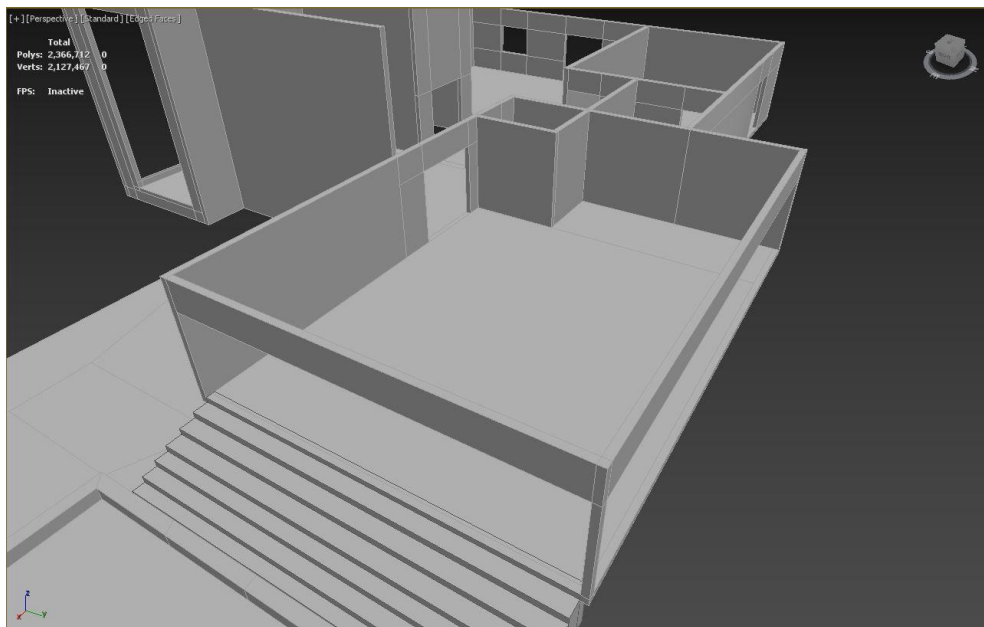


Figure 4.4.7 Leisure room walls

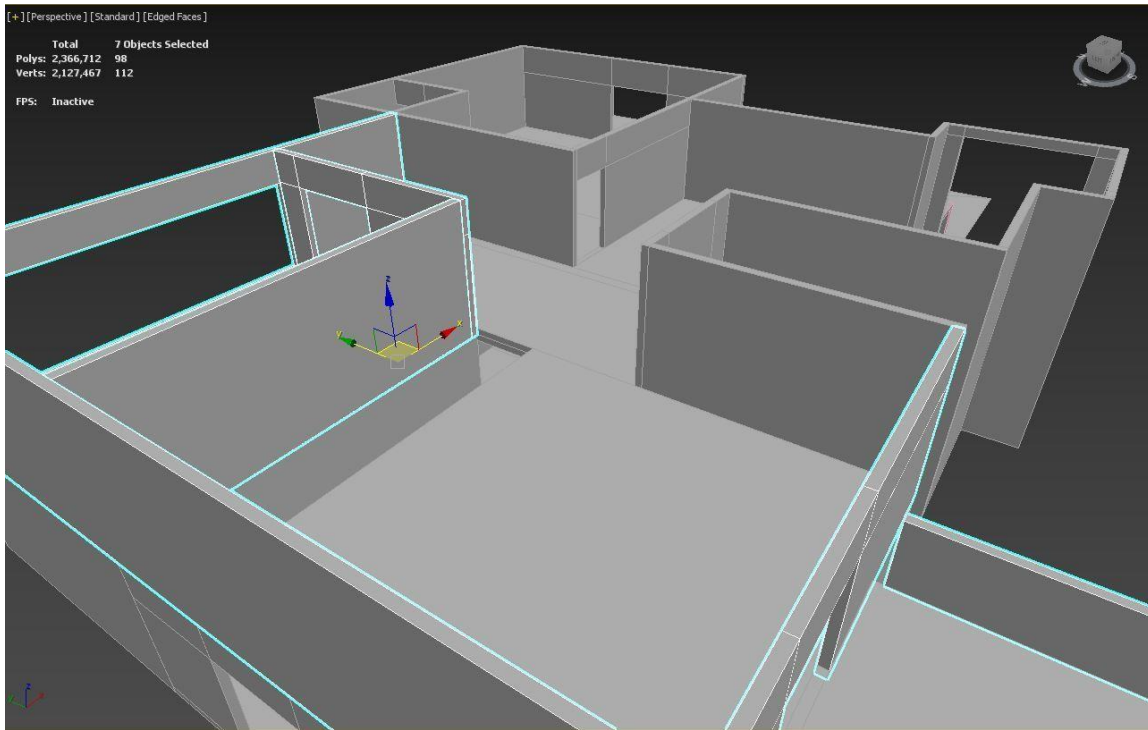


Figure 4.4.8 2nd floor walls

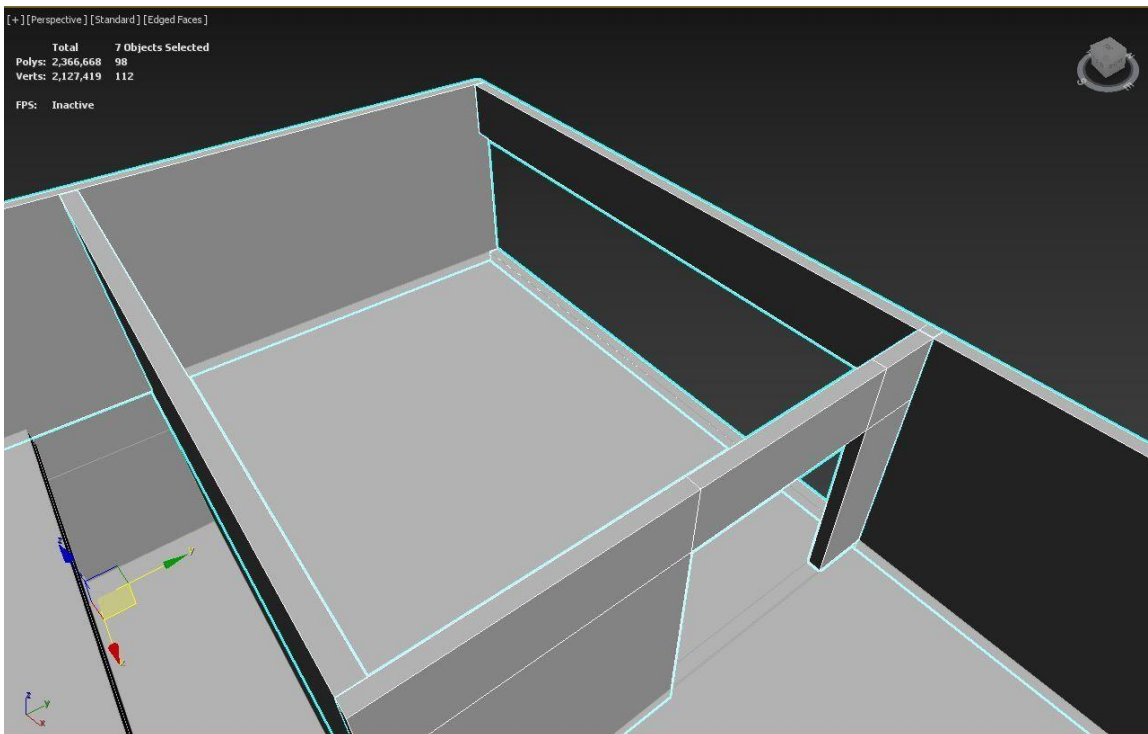


Figure 4.4.9 Gym walls

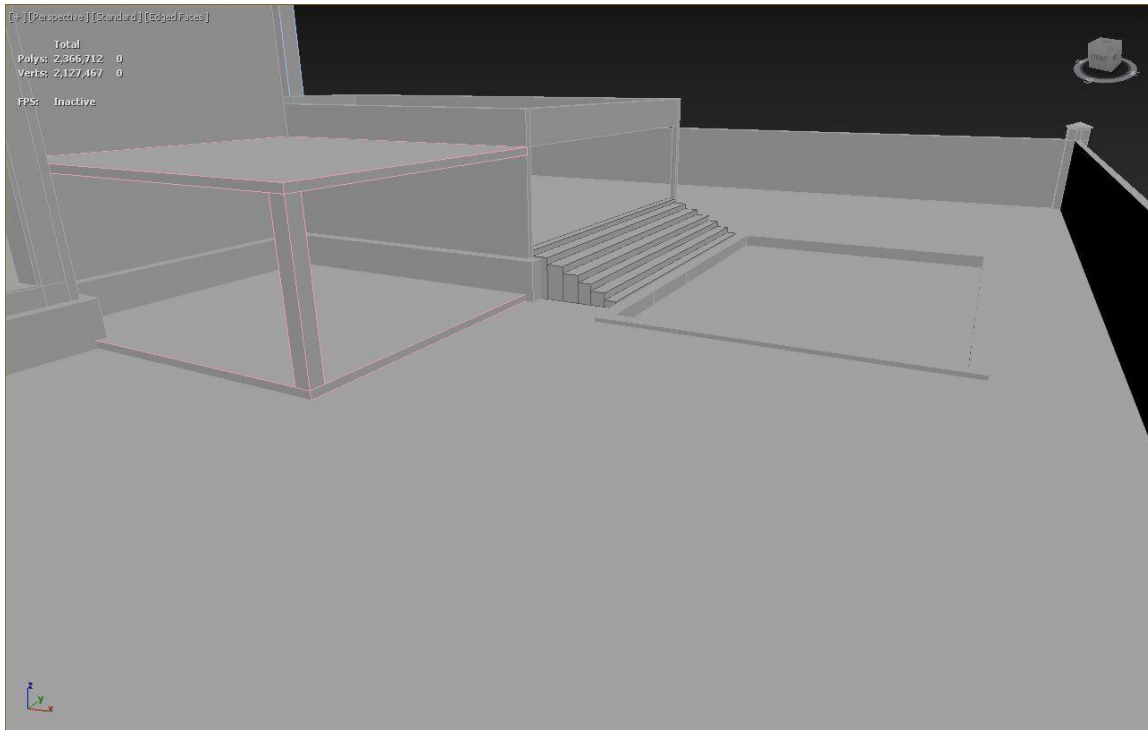


Figure 4.4.10 Swimming pool area

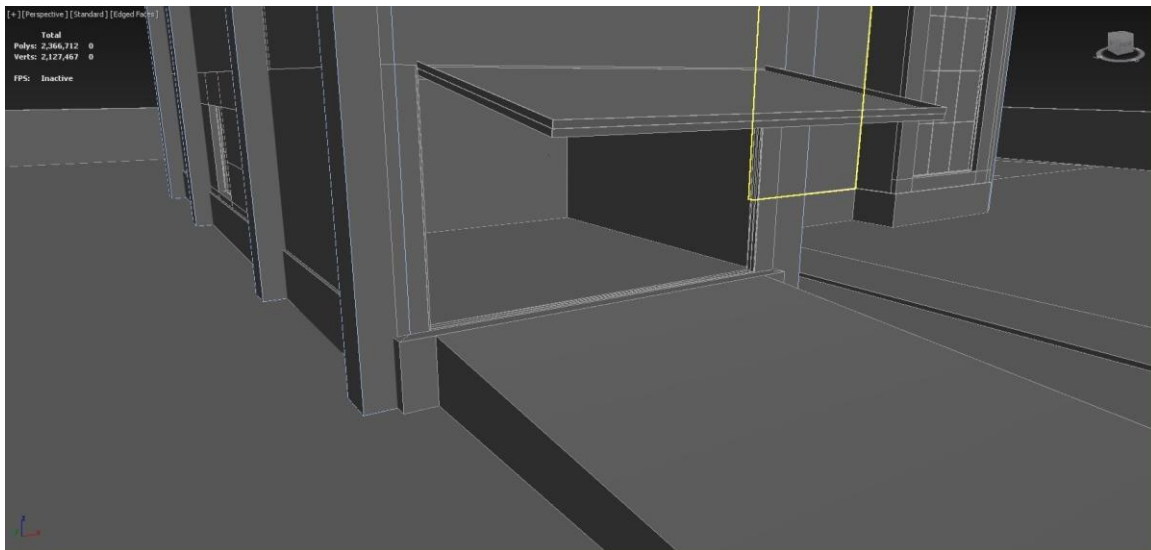


Figure 4.4.11 Garage walls

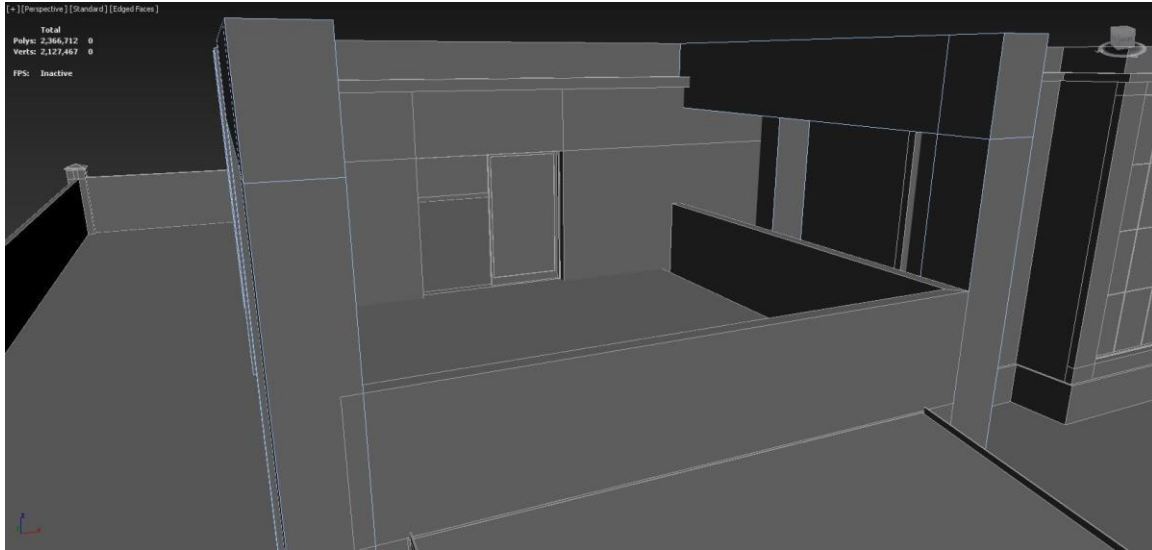


Figure 4.4.12 Veranda walls

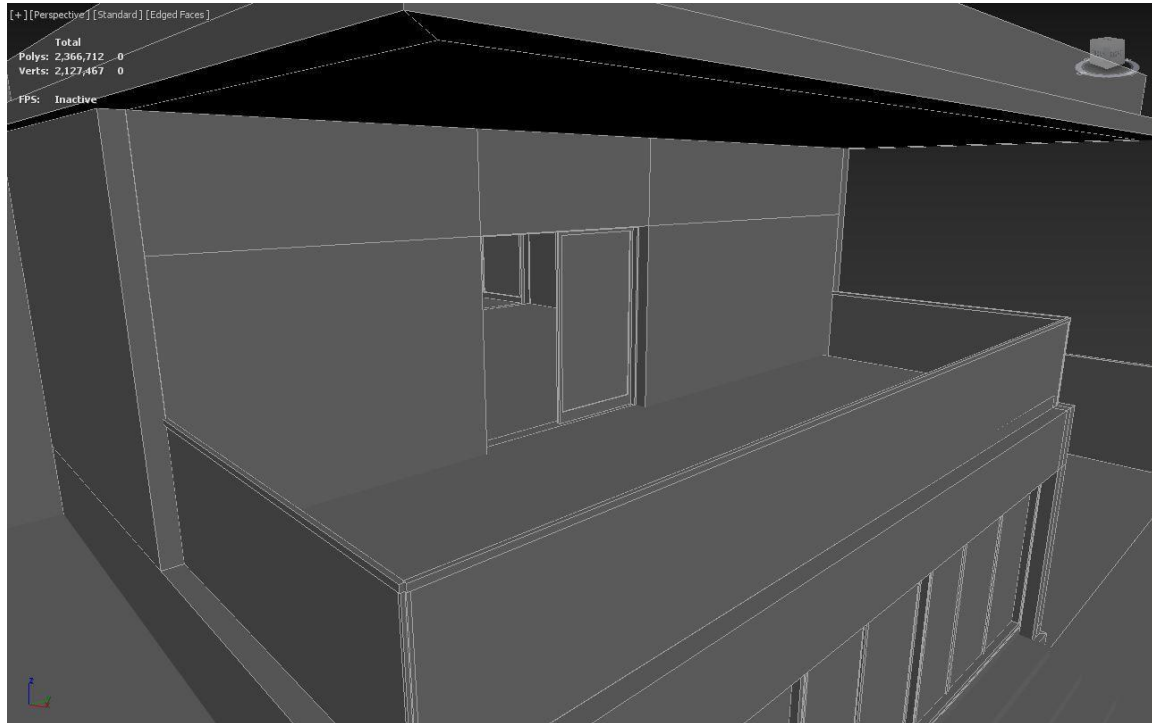


Figure 4.4.13 Balcony walls

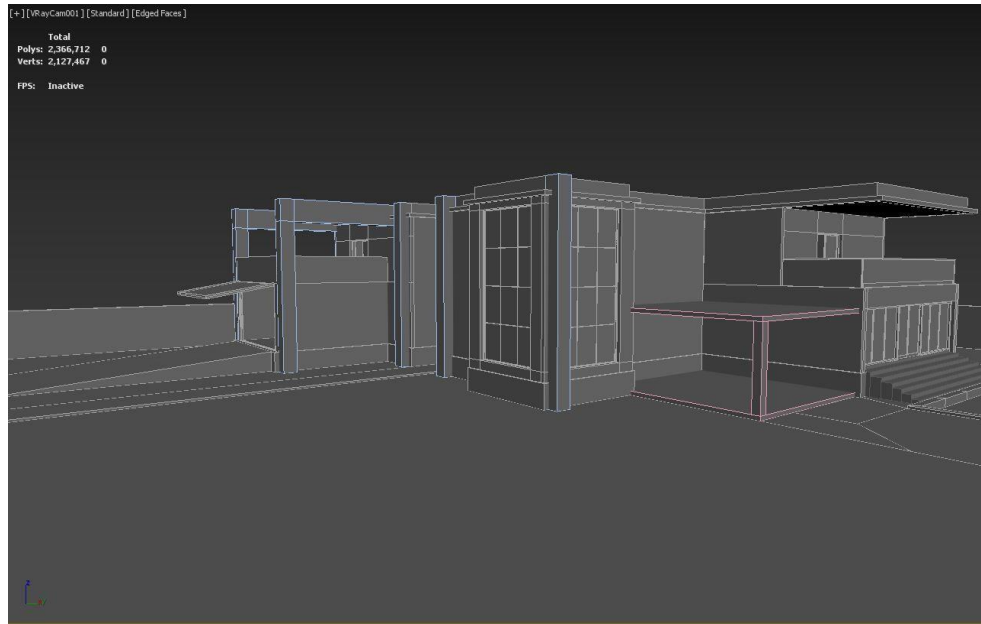


Figure 4.4.14 Full exterior

4.5: ASSET PRODUCTION

To create assets for this house I followed the references mentioned before. I have followed 3 different techniques to create the models for this project. The first technique is to create 3d models using 3ds max model generators. To create the doors and windows I used 3ds max's own door and window generator.

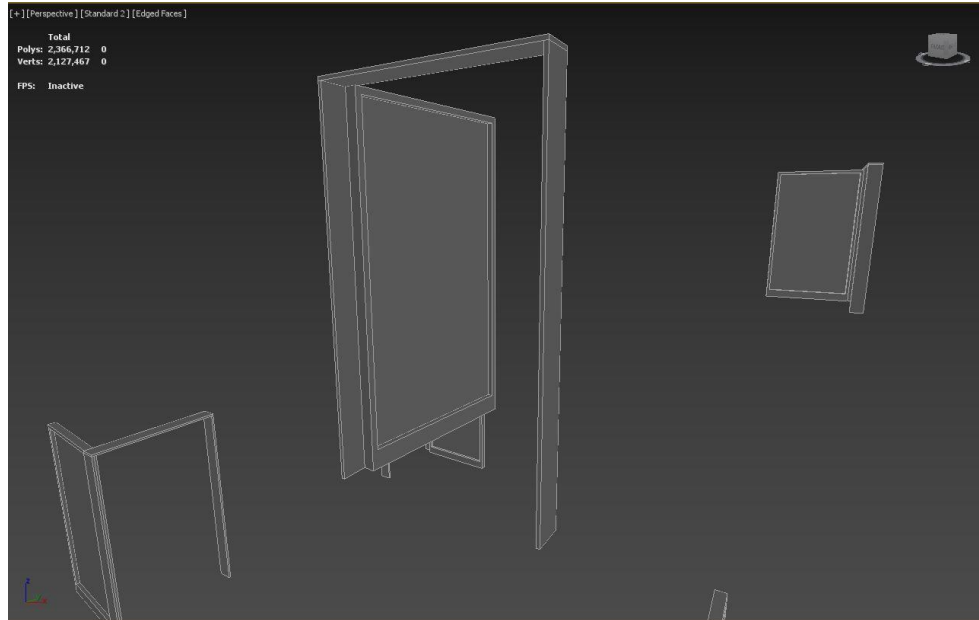


Figure 4.5.1 Doors

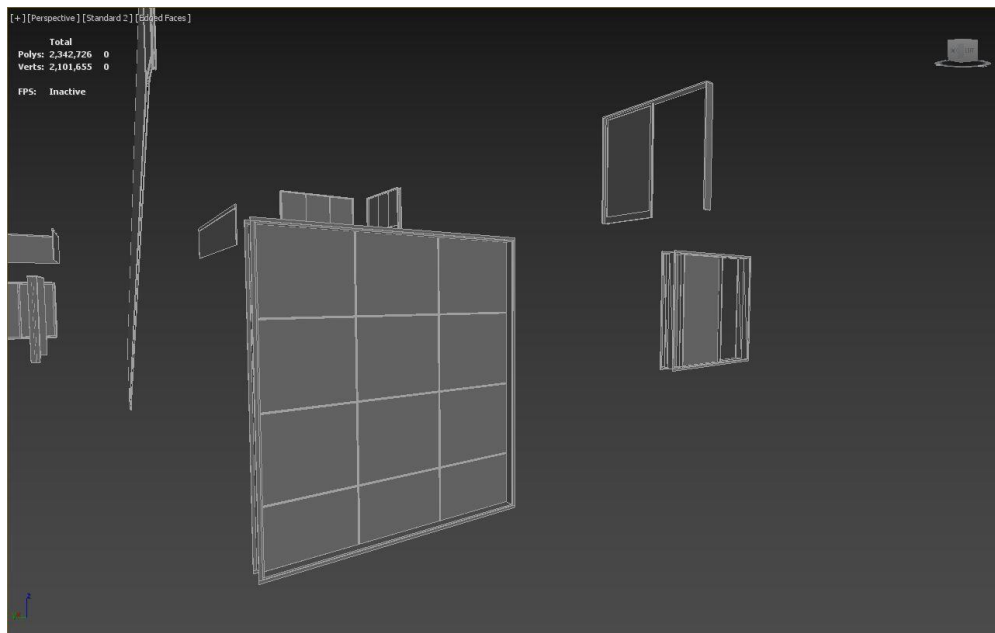


Figure 4.5.2 Windows

The second technique I followed is poly modelling. In this technique I took reference of an object and created its manipulating polygons of the model. This technique is used to create almost every 3d model in any pipeline. The ergonomic chair is modelled in this technique. Here are the clay model, wireframe render and final renders of one of the models I have created in this technique.



Figure 4.5.3 Clay model

Wireframe renders helps to see if the topology of the model is accurate. If there are any engons, flipped normal or any other mistakes creating this model in the wireframe render we can identify those.



Figure 4.5.4 Wireframe render

The uv mapping of this model is created in Rizom UV [15]. UV unwrapping helps to create seamless model and create photo realistic renders.

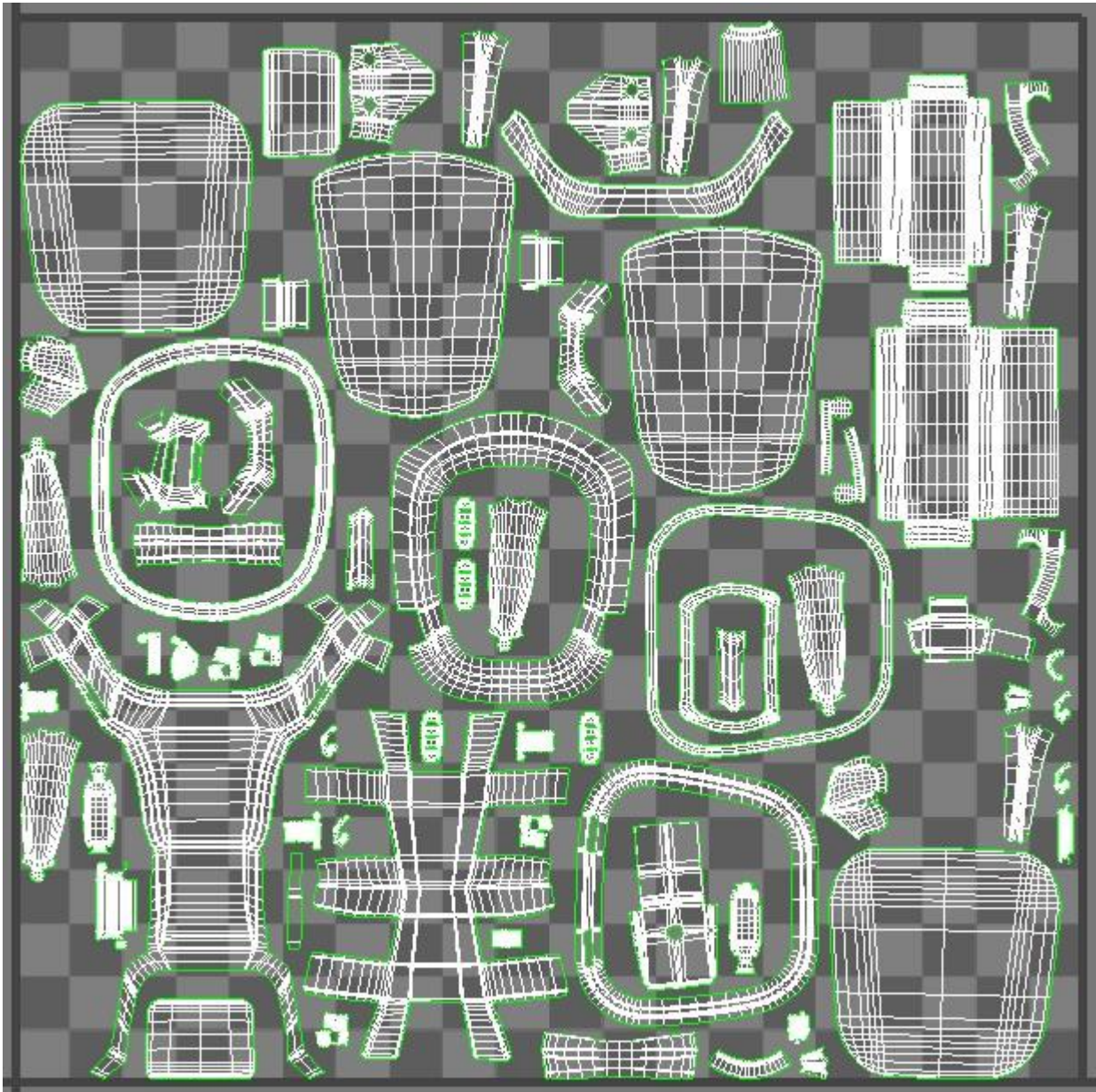


Figure 4.5.5 UV mapping

After creating the Uv map it is time to texturize it. I created the materials for this model in Substance painter [16]. Before taking the model to substance painter [16] I applied different vertex colours in different parts of the model to bake the vertex colour. This helps to assign different materials to different parts of the model. In substance painter [16] I texturized the model and baked

the textures. Here are all the textures I needed to render the final model. This is the base colour map of the model.



Figure 4.5.6 Base map This

is the metalness map.



Figure 4.5.7 Metalness map

The normal map helps to create depth in the model.

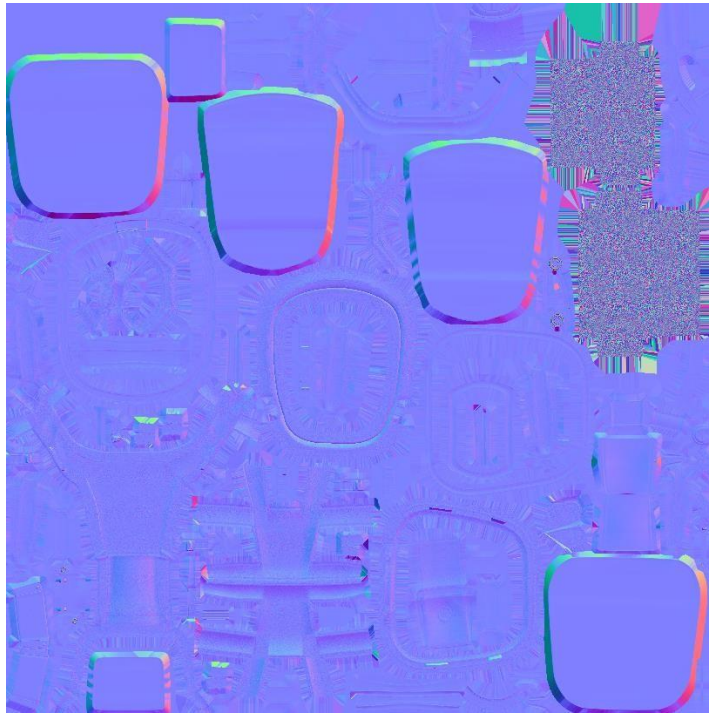


Figure 4.5.8 Normal map Here

is the opacity map.

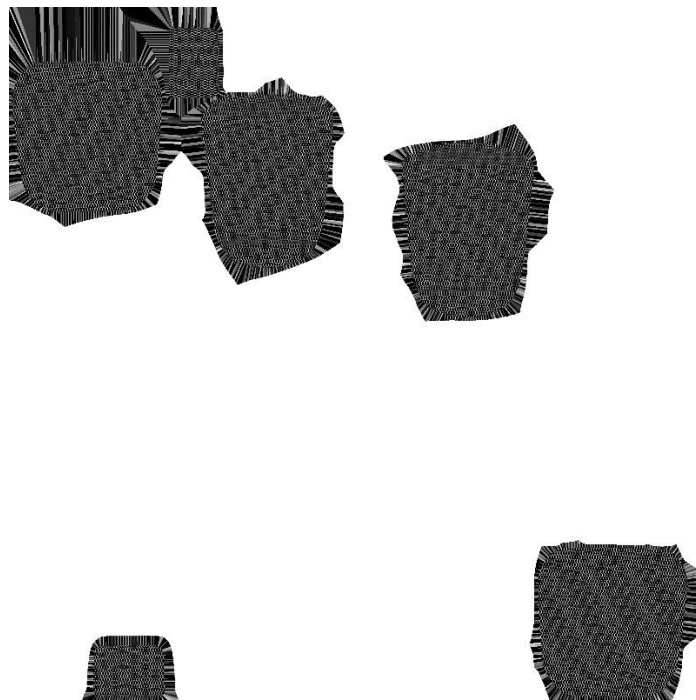


Figure 4.5.9 Opacity map

This is the Roughness map. The roughness map defines how glossy the object will be.



Figure 4.5.10 Roughness map

Here are some render outputs of the models I created in this way.



Figure 4.5.6 Final render 1



Figure 4.5.7 Final render 2

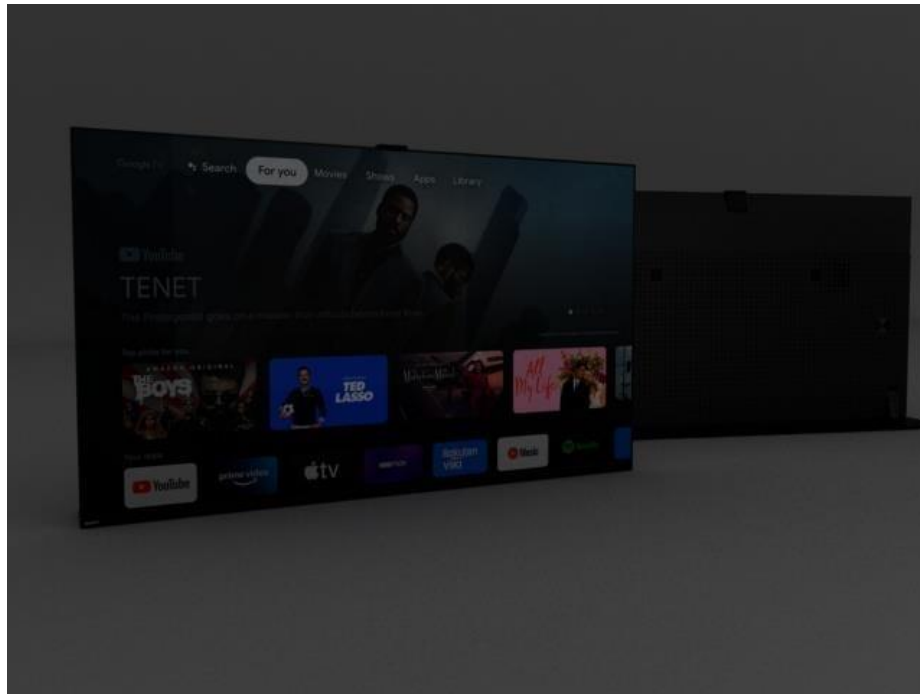


Figure 4.5.8 Tv



Figure 4.5.9 Wooden bench



Figure 4.5.10 Microwave oven

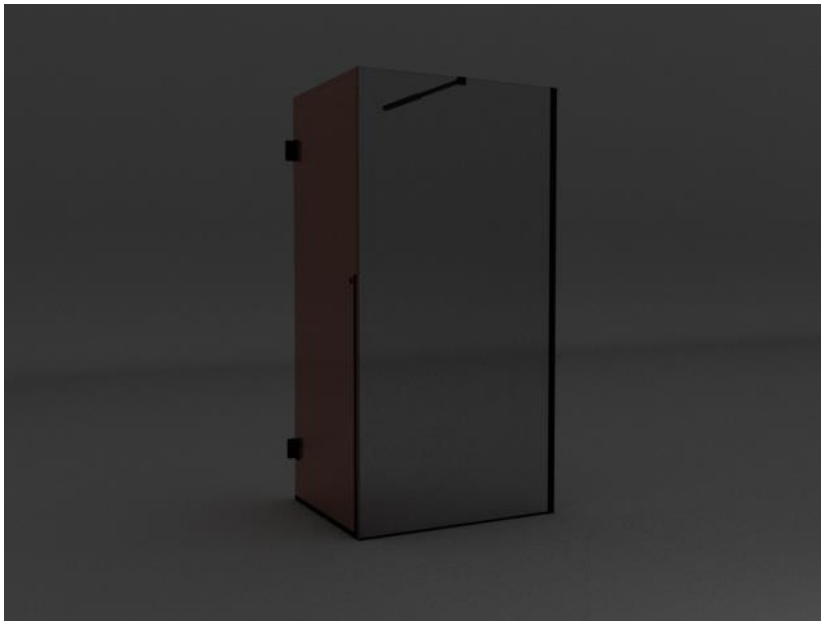


Figure 4.5.11 Shower cabinet



Figure 4.5.12 Metal wastebbin

The third technique I used to create models for this project is by downloading 3d meshes from Dimensiva [17] and applying ProOptimizer modifier on them. This modifier is built in to Autodesk 3ds MAX [14]. This modifier is very strong and helpful. It helps to reduce poly count of a model.

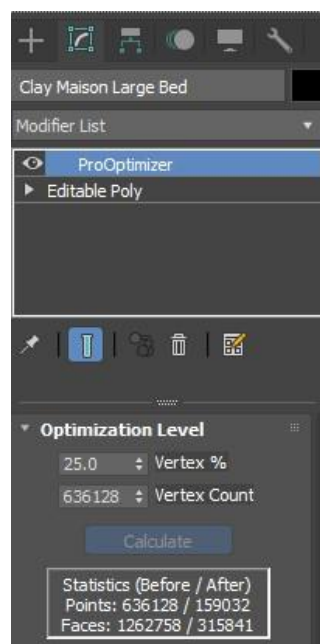


Figure 4.5.13 ProOptimizer modifier

Here we can see how this modifier is triangulating the polygons of this mesh and reducing the poly count of it. This modifier is very strong and accurate, It does deform the mesh and keeps the uv intact.

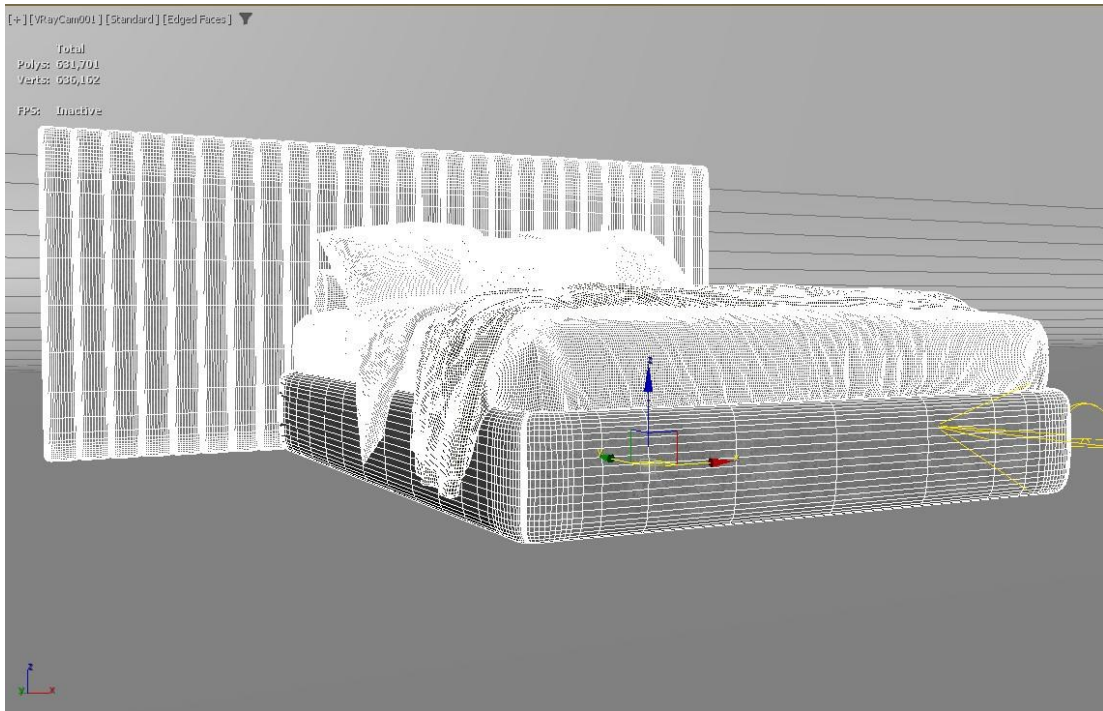


Figure 4.5.14 Bed before

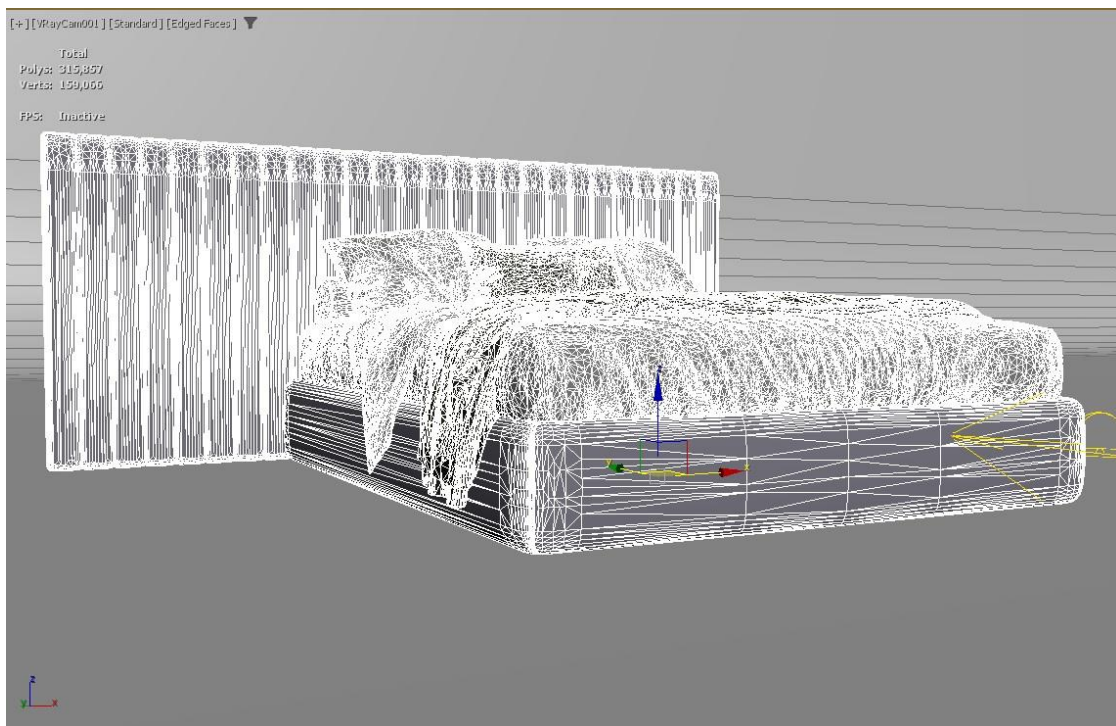


Figure 4.5.15 Bed after

Here is the rendered image of the mesh after reducing the poly count of it using ProOptimizer.



Figure 4.5.16 bed render

Here are some more renders of some other objects which I created in this technique.



Figure 4.5.17 Armchair1



Figure 4.5.18 Armchair 2

4.6: ASSET FINALIZING

After creating all the objects It was time to place them in to their places and finalizing them. If any of the objects didn't go with the structure Or didn't suit the theme I changed it with another model. After placing all the objects in their places I finalized the models for the final output. Here is the final placement of objects in the kitchen and dining area.



Figure 4.6.1 Kitchen This

the leisure room area after finalizing.

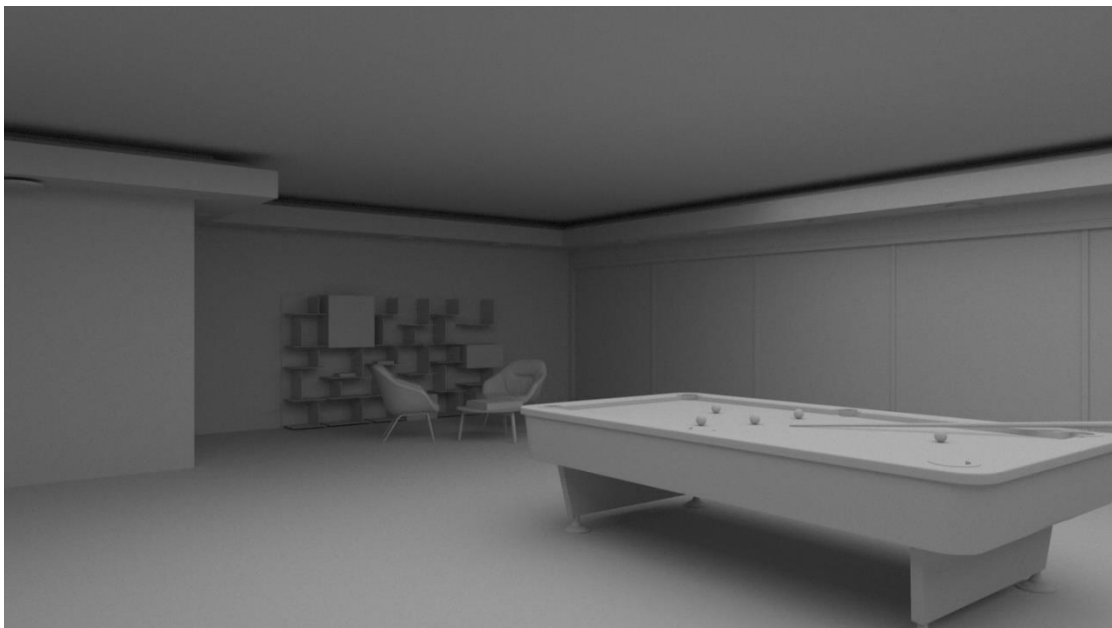


Figure 4.6.2 Leisure Room

The living room is filled with modern day furnitures.

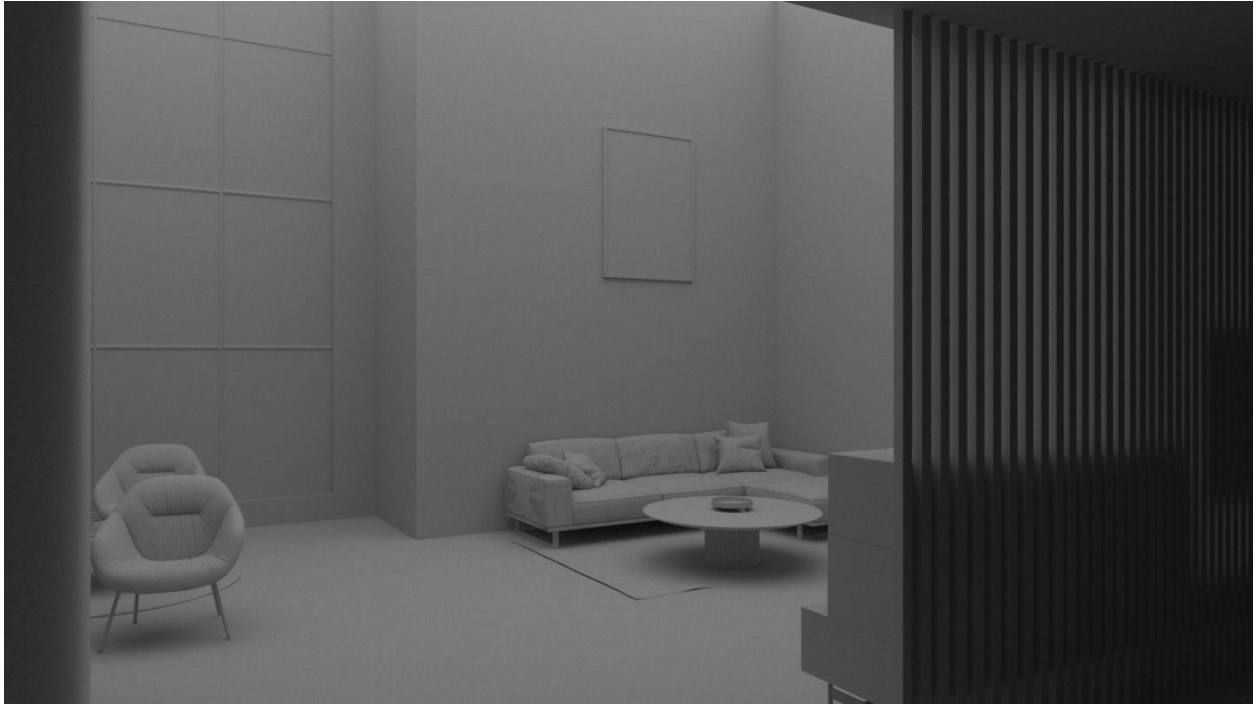


Figure 4.6.3 Living Room The

finalized bedroom.



Figure 4.6.4 Bedroom



Figure 4.6.5 Toilet

4.8: DELIVERING THE ASSETS

This is the last stage of my workflow. Delivering the assets in a form which will be very optimized and easy to work with. This project is created to see realtime renders in unrealengine. The most compatible file form to deliver in unrealengine is unreal datasmith. The biggest advantage of this form is that if I make any changes in the 3ds max [14] file it updates in unrealengine. It saves a lot of time and kept me away from extra hassel.

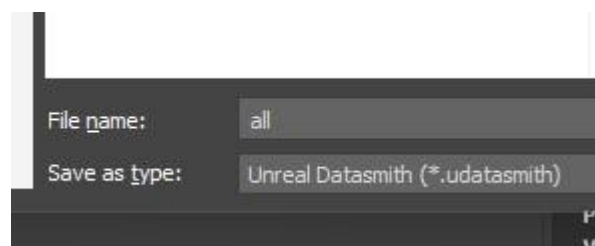


Figure 4.8.1 Exporting as Unreal Datasmith

CHAPTER 5

CONCLUSION

5.1: CONCLUSION

The world is heading toward an industrial revolution. And the Realtime industry leading this revolution. IF we cannot master art of this technology we will be left behind. Th pipeline in my project I have used is very optimized and user friendly. This will help us to grasp the techniques to lead the upcoming era. This line of work will change the architectural visualization industry. All the big companies are switching to this platform. If we can commercialize this pipeline we can guarantee a 100% satisfaction of the customers and generate huge revenues.

As I mention before this is not visualizing a piece of property we are trying to visualize ones dream and giving total freedom to customize it with their creativity. It is high time we dive deep into this field.

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