FINAL YEAR THESIS

PRODUCT VISUALIZATION USING COMPUTER GENERATED IMAGERY, DEVELOPING 3D MODELS, FX & SIMULATION, LIGHTING AND RENDERING

By

Takaiat lutfe

ID: 161-40-309

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

Supervised By

Arif Ahmed

Associate professor

Department of MCT

Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

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APPROVAL

This Project titled "**Product visualization using computer generated imagery, Developing 3D models, Fx & Simulation, Lighting and Rendering**", submitted by Takaiat Lutfe 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 December 26, 2019.

Board of Examiners

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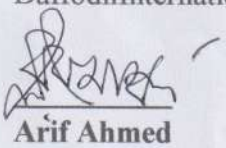
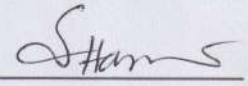
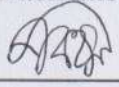
Associate Professor & Head — **Chairman**
Department of MCT
Faculty of Science & Information Technology
DaffodilInternationalUniversity



Arif Ahmed
Adjunct Associate Professor — **Internal Examiner**
Department of MCT
Faculty of Science & Information Technology
DaffodilInternationalUniversity



Md. Samaun Hasan
Lecturer — **Internal Examiner**
Department of MCT
Faculty of Science & Information Technology
DaffodilInternationalUniversity



Dr Mohammad Zahidur Rahman
Professor — **External Examiner**
Department of CSE
Jahangirnagar University

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DECLARATION

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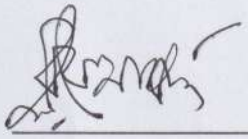

Arif Ahmed
Adjunct Associate Professor
Department of MCT
Daffodil International University

Submitted by:

Takaiat Lutfe

Takaiat Lutfe
ID: 161-40-309
Department of MCT
Daffodil International University

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I owe everything to my family who encouraged and helped me at every stage of my personal and academic life and longed to see this achievement come true. I dedicate this work to my pious grandfather, my sincere and generous father and my loving mother. Every breath of my life and drop of blood in my body is dedicated to my family. I love you all.

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ABSTRACT

The project aims to create a short product animation of a smart phone. This can be used for the purpose of advertisement and attracting consumer attention. The entire project was created using CGI (computer generated imagery) technology. My part on the project consisted of creating the 3D models, animation, lighting and rendering, fx and simulation for the project. Which were used for creating the assets such as the phone itself, creating movements and rendering the final image all in 3D. It was done using tools and techniques such as hard surface modeling, image based lighting, GPU (graphics processing unit) based rendering etc. In future, the project can show people of different industries the capability of CGI to produce attractive advertisements for products.

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TABLE OF CONTENTS

CONTENTS	PAGE NO
Approval	i
Declaration	ii
Acknowledgement	iii
Abstract	iv
Table of contents	v
List of tables	vii
List of figure	viii

CHAPTER

CHAPTER 1: INTRODUCTION **1-3**

1.1 Introduction……. 1
1.2 Project goal……. 2
1.3 Target Audience…… 2
1.4 Project timeline……... 3

CHAPTER 2: LITERATURE REVIEW **4-12**

2.1 CGI Works in 3D Advertisement Industry……. 4
2.2 Storyboarding…… 5
2.3 Modeling…… 5
2.4 texturing…… 7
2.5 Lighting…… 8
2.6 Rendering…… 9

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2.7 Simulation…… 10

CONTENTS **PAGE NO**

CHAPTER 3: MODELING **13-23**

3.1 Introduction……. 13

3.2 Modeling procedure…….. 13

CHAPTER 4: LIGHTING **24-33**

4.1 Introduction…… 24

4.2 Lighting procedure……. 24

CHAPTER 5: FX AND SIMULATION **34-46**

5.1 Introduction…… 34

5.2 Fx and Simulation procedure…….. 34

CHAPTER 6: RENDERING **47-51**

6.1 Introduction…… 47

6.2 Rendering procedure……47

CHAPTER 7: CONCLUSION **52**

Conclusion……52

REFERENCES……...…….. 53

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LIST OF TABLES

TABLES **PAGE NO**

Table 1.4.1: Gantt chart of Product visualization

using computer generated imagery of mobile Adverting. 3

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LIST OF FIGURES

FIGURES	PAGE NO
Figure 2.3.1: Polygonal modeling	6
Figure 2.3.2: Curve modeling	6
Figure 2.3.3: Sculpture modeling	7
Figure 2.4.1: Texture model of a helicopter	8
Figure 2.5.1: light setup for a scene	9
Figure 2.6.1: Render Engines	10
Figure 2.7.1: Smoke Simulation	11
Figure 2.7 2: particle Simulation	12
Figure 2.7.3: water simulation	12
Figure 3.2.1: Setting reference image for modeling	13
Figure 3.2.2: adjusting polygon box shape	14
Figure 3.2.3: Polygonal cube to mobile shape	14
Figure 3.2.4: beveling edge of cube	15
Figure 3.2.5: making screen of phone	15
Figure 3.2.6: test rendering a frame	16
Figure 3.2.4: Making hole for button	16
Figure 3.2.5: adjusting vertex of hole	17
Figure 3.2.6: smoothing whole	17
Figure 3.2.7: making sound box hole by Boolean	18
Figure 3.2.8: Modeling Charger, Microphone Hole	18
Figure 3.2.9: Modeling the slim card slot	19
Figure 3.2.10: modeling side buttons	19
Figure 3.2.11: modeling volume button	20
Figure 3.2.12: making popup camera	20
Figure 3.2.13: Back camera model by reference	21
Figure 3.2.14: High details of back camera parts	21
Figure 3.2.15: making building from cube	22
Figure 3.2.16: Making different type of building	22
Figure 3.2.17: Making different type mobile	23
Figure 3.2.18: making building city with mograph	23
Figure 4.2.1: HDRI MAP	24
Figure 4.2.2: Octane Sky hdri adjusted	24
Figure 4.2.3: Octane sky hdr test render	25
Figure 4.2.4: tweak Octane sky Hdr	26
Figure 4.2.5: Octane sky hdr Test render	26
Figure 4.2.6: Render without Hdri map	27
Figure 4.2.7: Render with Hdri map	27
Figure 4.2.8: lighting the windows	28
Figure 4.2.9: lighting with buildings and windows	28
Figure 4.2.10: flat render of lighting	29

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FIGURES **PAGE NO**

Figure 4.2.11: Hdri map added 29
Figure 4.2.12: Rendering the scene 30
Figure 4.2.13: flat render of scene 30
Figure 4.2.14: Hdri map to make scene realistic 31
Figure 4.2.15: render with gradient background 31
Figure 4.2.16: processor default render 32
Figure 4.2.17: processor with hdri map render 32
Figure 4.2.18: final render of scene 33
Figure 5.2.1: Use of sweep subdivision surface 34
Figure 5.2.2: Use of Array Modifier 35
Figure 5.2.3: Use of Step Modifier 35
Figure 5.2.4: Inside view of scene 36
Figure 5.2.5: Creating of tube for shockwave 36
Figure 5.2.6: Use of Plain Effector 37
Figure 5.2.7: Use of Plain Effector 37
Figure 5.2.8: render of the fx effect created 38
Figure 5.2.9: Array Effector for camera lens 38
Figure 5.2.10: Lens organized 39
Figure 5.2.11: Plain Effector 39
Figure 5.2.12: Use of Formula Effector 40
Figure 5.2.13: Use of array Effector 40
Figure 5.2.14: Use of Plain Effector 41
Figure 5.2.15: render view of scene 41
Figure 5.2.16: cloned by array effector 42
Figure 5.2.17: Use of Array Effector 42
Figure 5.2.18: Use of Plain Effector 43
Figure 5.2.19: Models for the jet scene 43
Figure 5.2.20: Jet mirrored 44
Figure 5.2.21: Jet path traced 44
Figure 5.2.22: Jet path traced 45
Figure 5.2.23: Turbulancefd for simulation 45
Figure 5.2.24: Smoke simulation 46
Figure 5.2.25: Render view of smoke simulation 46
Figure 6.2.1: Render setting 47
Figure 6.2.2: Octane Render setting 48
Figure 6.2.3: Octane Render setting 48
Figure 6.2.4: Render image 49
Figure 6.2.5: Render image 49
Figure 6.2.6: Render image 50
Figure 6.2.7: Render image 50
Figure 6.2.8: Render image 51
Figure 6.2.9: Render Image in folder 51

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CHAPTER – 1

Introduction

1.1 Introduction:

Animation is about generating sequential drawings or pictures by way of various procedures for creating movement. It creates an optical illusion through which we are able to see still images or drawings rapidly moving. Animation is the only medium that can bring our fantasies to life. 3d animation is the future with the advance of technology such as AR and VR. This took our entertainment sector to a new height and connecting real and virtual with the help of 3d. Making 3d animation is complex and timing consuming process. Every Elements has to have an accurate value to make a realistic 3d animation.

Artists and Filmmakers uses Computer Generated Imagery (CGI) as a tool to better tell their stories in abstract ways. CGI is not just computer-generated imagery but also combination of thoughts, designs, experiments, and art of artist. In recent years the use of 'Computer Generated Imagery' (CGI) in advertisement industry has grown immensely. A big percentage of advertising industry is adopting CGI for better telling their stories. Now a Days Big Mobile phone companies such as Samsung, Apple, Xiaomi, Huawei uses high quality CGI advert to attract its consumer. Such as Galaxy S10 advert of 2019[1], Redmi Note7 of Xiaomi brand [2,3]., iPhone x [4,12].

Apple, Samsung, Xiaomi, Huawei Makes high quality standard 3d advert. Their most of the 3d advert are more simple, attractive, entertainment and communicative. Their short duration 3d adverts says thousand words. The numerous features of the phone are conveyed effectively to the viewer which boosts product selling chances. Brands 3d advert deliver a realistic virtual showroom experience on mobile. Now a day's people's like to watch the latest feature available Offered by their favorite brands and 3d advert offering them more attractive and dynamic visualization.

This project report displays the review of working process of making a standard mobile advertising with the help of different techniques and 3d software's. The report is the guide for the making a CGI mobile advert animation that portrays modelling to animation of the product and final output for customers in the market. The animation has to very eye catchy. So that it can attract viewer attention and hold it. Syncing the animation to music can help achieve this. It will also add a rhythm to the animation making it look much more interesting. I will have to aim for snappy and fluid motions during the animation to achieve a good fun quality of animation. Cinema 4d [14] will be my choice in animating the advert, as it good for motion and abstract art making.

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1.2 Project Goals:

The goal of this project is to create a CGI Advertisement which portrays mobile phone features in abstract, attractive, entertainment and commutative manner. Our country is still quite behind in producing good quality CGI for product advertisement. Often Bangladeshi mobile adverts fail to fulfil its purpose compare to others outside of country. Local mobile companies are also unaware of the uniqueness of 3d advert standard in recent mobile industry. There is a huge market for advertisements in Bangladesh. It is rapidly growing. Expected to grow by $457 million between 2017 and 2020. This report clarifies the step by step to create a standard mobile advert which can be compared with outside advert of our country, Also,branding for out mobile phone companies.

Mobile CGI Adverts is generally fun to watch and creates a higher viewer engagement than traditional adverts. It helps us to be a lot more creative as we can present almost anything in animation, we don't have to stick to what is realistic or possible as you would with live. As 3d is developing in Bangladesh, in future it will be create a great impact in Bangladesh. With CGI, we can show our product from all angles, in different colors, and in all variations.
live-action advertisements are time-consuming process than Animation. We can immediately edit an animated work but the actual video editing when the work must be done after the initial shooting. Investing in animated advertising can give local mobile companies a much larger return while still providing a means to attract our country customers.

1.3 Target Audience:

Our target audience this project are young people of age from 18 to 35 people who loves to see attractive features and pleasing color with their taste for their phones. Communicating with audience is the primary target for this advisement. The goal is to establish interest and mind set to buy the tempting upcoming mobile. With this in mind we have decided to use gradient color for our phone advertisement and keep it in one gradient color because it catches eyes, gives different tone, vibe for taste of youth and gradient color are more expressive the traditional one solid color .We have used gradient color of purple and sky blue where purple is used to express royalty, power, ambition, independence, peace, pride, mystery, and magic. On the other hand, blue used for trust, loyalty, wisdom, confidence tranquility and calmness for the youth to middle age.

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1.4 Project Timeline (Gantt chart):

Gantt is can be said as backbone and very important for any project to keep up with the plan. Gantt represent the Project schedules, Activities, Clear visibility of Dates and Time Frames and helps to effectively manage the Team. This graph is like a bar diagram where the works will be done are marked with bars from the being date to complete date of the final point of project. This project will take time span over a sixteen weeks schedule. The timeline is very tight so it has to be managed correctly and this the guide which will keep us on track.

Table-1.4.1: Gantt chart of Product visualization using computer generated imagery of mobile Adverting. My parts are highlighted in red.

			Week															
Number	Task	Total Duration (weeks)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
01	Research	1																
02	Brainstorming	1																
03	Concept development	6																
04	Collecting reference	3																
05	Storyboarding	2																
06	Modeling	4																
07	Texturing	7																
08	Lighting	5																
09	Animating	5																
10	Fx and Simulation	4																
11	Rendering	1																
12	Audio	2																
13	Editing	2																

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CHAPTER – 2

Literature Review

2.1 CGI Works In 3D Advertisement Industry:

3D advertisement is the recent industry standard for product visualization.3D in advertising industry is offering a wide range scope for 3d artist to display their creativity, which is essential for attracting consumer at present 3d based generation. Popular mobile brands such as as Samsung, apple, Xiaomi, Huawei, Oppo are successful at their sales through creating market value among its consumer with help of CGI based mobile Advertising and is one of their primary means for Advertising products for them. Iphone is focus on to take a giant leap forward in mobile photography giving extra edge to image quality with high resolution and zoom which was beautifully displayed in the promo for IPhone X [4,12]. Their camera angle, movement, color tone, transitions and blending shorts are inspiring and I will be focusing to get those kind of short in our advert.

Samsung is focused on their design and processing platform targeting business class people. Their main focus was extra-large display, elegant design, multitasking platform, also better camera quality, those features were attractively shown in their Galaxy S10 advert [1]. This type of work has inspired us to work on our short division of 3d Avert mobile. The color and concept brands uses for communicating and delivering for target are quite fantastic, holding rhythm to the animation is unique. The mobile 3d advert quality of our local brand far behind then of outside our country. Also, its hard to find any 3d advert for local brand such as Walton. Compare to outside brands our local band fails to create impression among user and our country is not developing in advert industry.

Recently, OPPO released a new series called Reno, hoping to encourage everyone to make life more imaginative through creativity.[5]. So, they hope to create a magical city, but the seemingly ordinary scene will be unexpectedly changed. The main feature of their product was the 10X optical zoom. So they tried a lot of exaggerated lens movements, hoping to let the audience intuitively feel the "zoom" experience.

Another china company which is creating great market value with their CGI 3d advert is Huawei[6].There is more clear and simple target the core feature their giving to consumer such as dust/water resistance , longer battery etc. are amazingly visualized. Huawei p9 design work was inspiring in 2016[7].Also honor 20 promo[8] where The fantasy environment and amazing imaginary animals are emphasized with stylized color and lighting condition to create a variety of exotic tonality. Honor logo identity is created with growing exotic plants & owers. As the viewer camera gradually penetrates into the logo, the plants and owers start to grow plentifully, and they are shown in the whole screen. The

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variety of Wonder natures is displayed with Honor 20. Those kinds of color and abstract things should easily attract customer.Xiaomi is also has established them as high quality brand in asia. Their mobile 3d advert visualization is extra ordinary. such as the advert of Redmi K20 Pro[9] , or Xiaomi Mi 2[10], Xiaomi Redmi 5 [11]. The concept of their mobile was nicely presented with abstract design. All the features were abstractly presented and a smooth and cool color visualization is done matching their mobiles color.

Those types of work inspiring for 3d advert in advertising industry. As our country is in search of quality, if we can follow and deliver that kind of visualization, our country mobile can also get high market for 3d Advertising. As Bangladesh is getting familiar with 3d works, so our country brands need to acknowledge the important of 3d advert for showing more futuristic feature to audience and attract their attention.

2.2 Storyboarding:

Storyboard is used to step by step visual representation of our story, narratives, and sequence of events. It can be also said as a blueprint for the 3d animation .it helps to visualize and sync with other part of the scene (Such as audio, transitions, etc). Storyboarding is an essential part of producing an animation, which help to check whether the narrative in the script makes any sense when it's translated into a series of visual shots. Storyboarding helps artist to visualize camera angles, composition, point of view, hookups and continuity, object and character motion, cuts, posing, and, pacing

2.3 Modelling:

In CGi 3D modeling is a technique that uses to create a 3Dimensional object with the help of 3d software. Artists make a 3d model by manipulating the state of the basic shape or deforming the mesh to desired model with the help of different 3d software's. Every 3d Model has vertices, edge and face or polygons though which user manipulate 3d object and computer calculate those so give user desire shape. There many type of modeling which can be used for 3d model among them notable are polygonal modelling where primitive shapes as polygons are manipulated , curve/line modeling where models can be created by the help of line drawing surface are created , and sculpture modeling where artist mold shapes like clay and easily gets desire model and so on.

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Here the poly modelling techniques are shown. From start a simple cube is modified with the exclude, bevel tools etc the vertex, faces,edge are modified

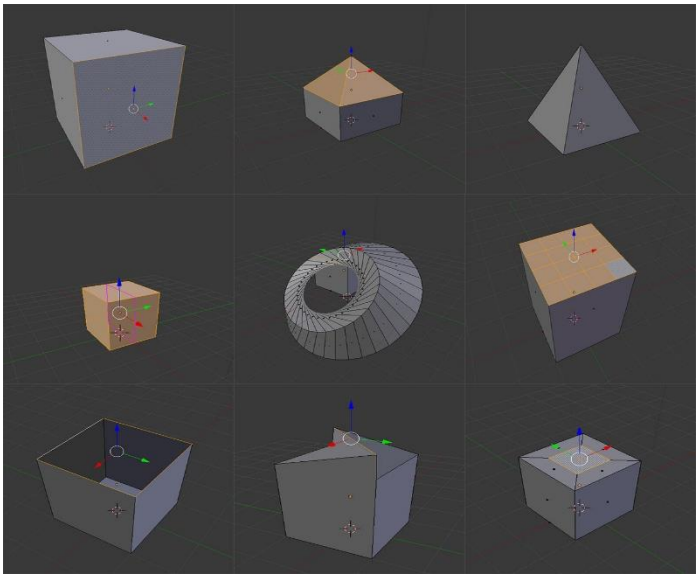

Figure 2.3.1: Polygonal Modeling

Another technique to make 3d models is the curve modelling. This is technique the user draws line and then those is extruded in to mesh for further modelling. Different type of shapes can be drawn with different curve or line tools.

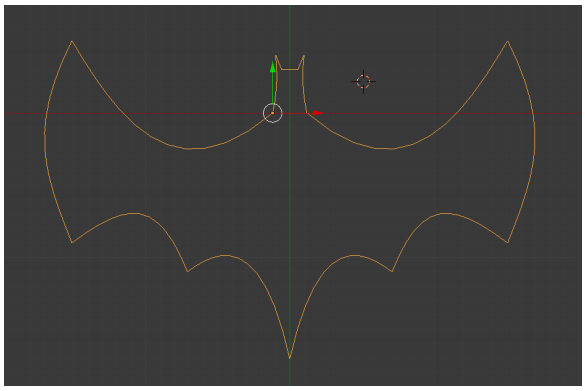

Figure 2.3.2: Curve modeling.

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3d sculpture technique very creative form of making 3d model where the artist can create abstract model by molding geometry shaped with brushes and tools that push, pull, pinch and smooth make it easy to create detailed sculpts .

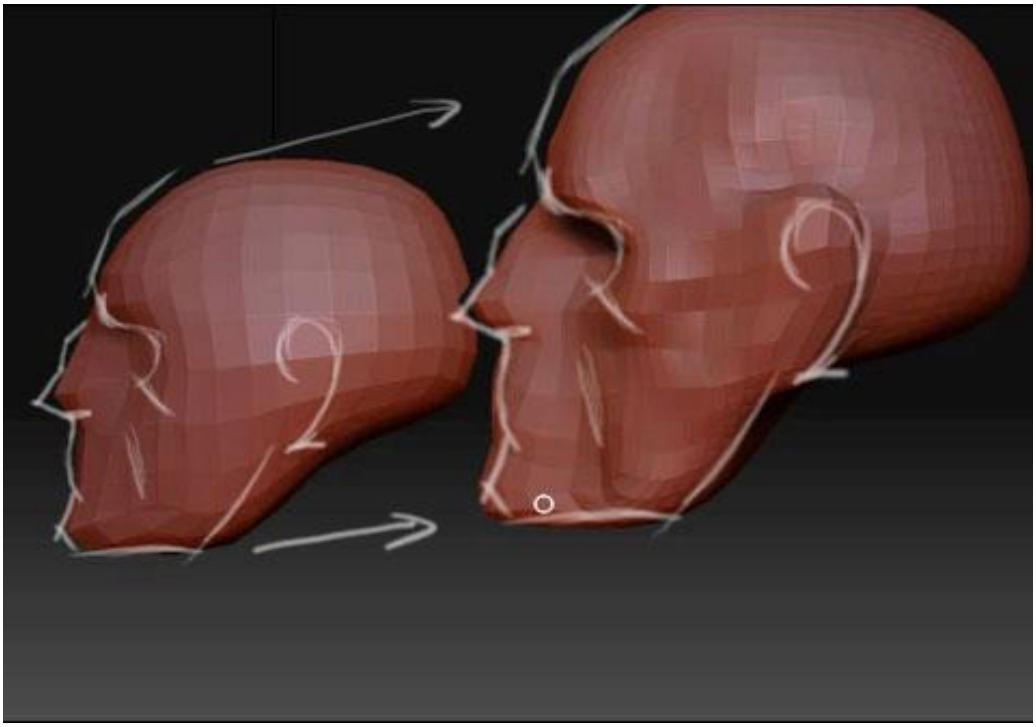

Figure 2.3.3: Sculpture modeling

2.4 Texturing:

Texturing is one of the main stages of three-dimensional model creation Texture is an image that is being projected on a surface of 3d dimensional object that gives the impression of a real object. Texture has coordinated which are pairs of numbers stored in the vertices of a mesh. Those coordinates which are three-dimensional in their nature, represents a position within the texture's volumetric space. Texture gives realistic details to the surface.

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3D model may have multiple materials assign to it but only has one texture. Texture controls various channels of object surface such as RGB surface, Greyscale surface, alpha channel surface and others. There are also multiple properties maps combined to get illusion of realistic effect. Those maps are Bump map, Normal map, Displacement map, Reflection map, Specular map, Height map, occlusion map and others. Texture can be made by an artist by a 2d software such as photoshop and sometimes artist prefer to take photograph of real life object to get realistic details their desired object.

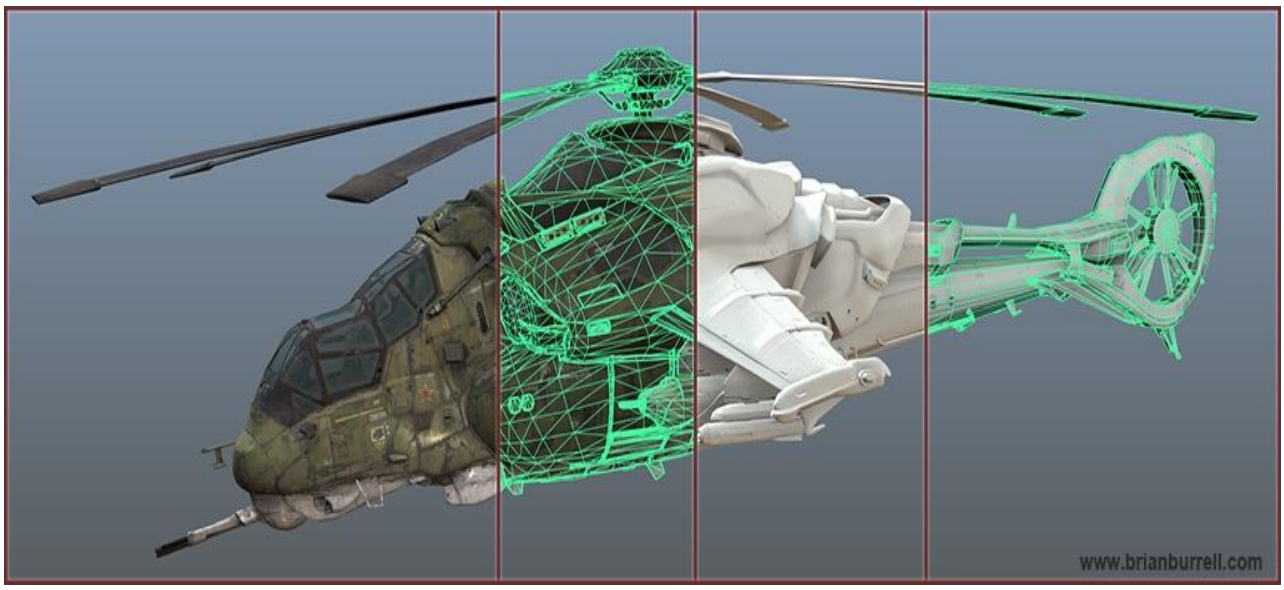

Figure 2.4.1: Texture model of a helicopter

2.5 Lighting:

In CG for creating hyper-realistic 3D scenes lighting is a critical part. one of the most important elements of any visual representation is lighting as it helps to the human eyes to perceive visually. For creating a perfect real world like scene in cg, we have to use real world examples and to study how these virtual renderings are achieved. A 3d artist has to have deep level of knowledge on how real-world light interacts and reacts in different situations. Light one of the most important aspect because it setup the mood of viewers and make a flat molded model realistic as the illumination from the light source simply bounces

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back from the objects that we see in the field of sight. In cgi light can Enhance or creating the mood of a scene, Create the illusion of depth, Create the illusion of volume, Reveal the substance and qualities of materials, integrate visual elements, set a visual style and Create visual interest. There are many type of lights available different 3d software according to need such as Ambient Light, Area Light, Diffuse Light, Specular Light, Positional Lights, Emissive Light, Directional Lights, Spot Lights etc. For getting studio type lighting and reflection on object we imaged based lighting with the help of HDRI map. HDRI is a panoramic photo, which has all angles of an area from a single point and contains a large amount of data which helps to the illumination of CG scene.

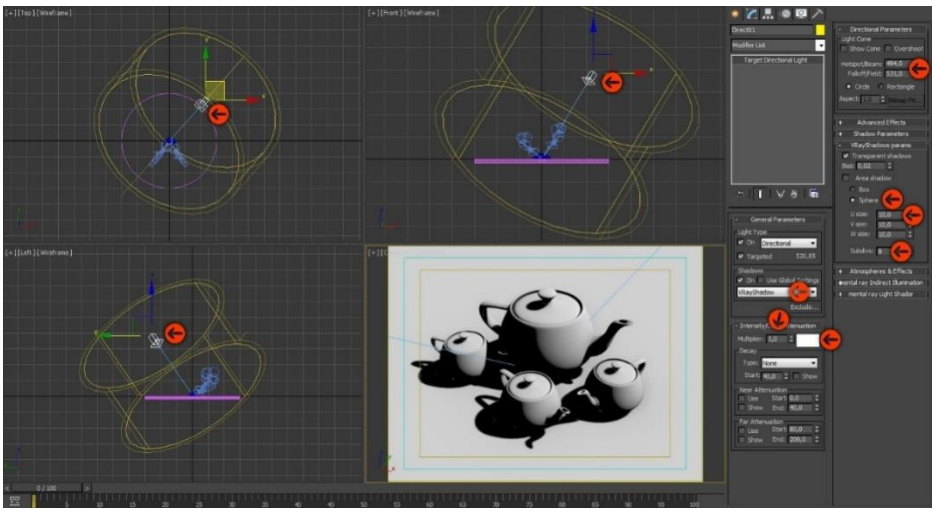

Figure 2.5.1: light setup for a scene

2.6 Rendering:

Render engine is a module responsible for generated CGI. the job of a rendering engine is to convert the applications internal model into a series of pixel brightness's that can be displayed by a monitor. Rendering engine gives the final appearance to models with visual effects such as shading, shadows, reflections and motion blurs, texture mapping. Render engine calculated all the aspect such as geometry, texture details, light, so on in one frame and give output as picture format. It is time consuming process. There many famous render engines available, serving for different purpose of users. Among them few are Vray,

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Arnold, corona, Iray, Mental ray, Maxwell, Octane renderer, keyshort etc are highly used in industry for rendering of CGI.

Figure 2.6.1: Render Engines

2.7 Simulation:

3D Simulation is basically complex calculation done by computer to find the interaction of a large number of object and particles with each other which affected by the natural physics type forces such as gravity and wind to show real life alike results. This a very time consuming but very interesting process that combines with 3d. With the 3d simulation software one can easily create realistic fire, smoke, explosions, and other gaseous

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phenomena. There are a lot of software available at the market to do the simulation works and plug-ins for using in 3d software such as Realflow, Houdini, Autodesk Max, Autodesk Maya. Here the smoke simulation has been demonstrated,with the help of real life physics this simulations are done and real life alike smoke with fire is made in various softwares.

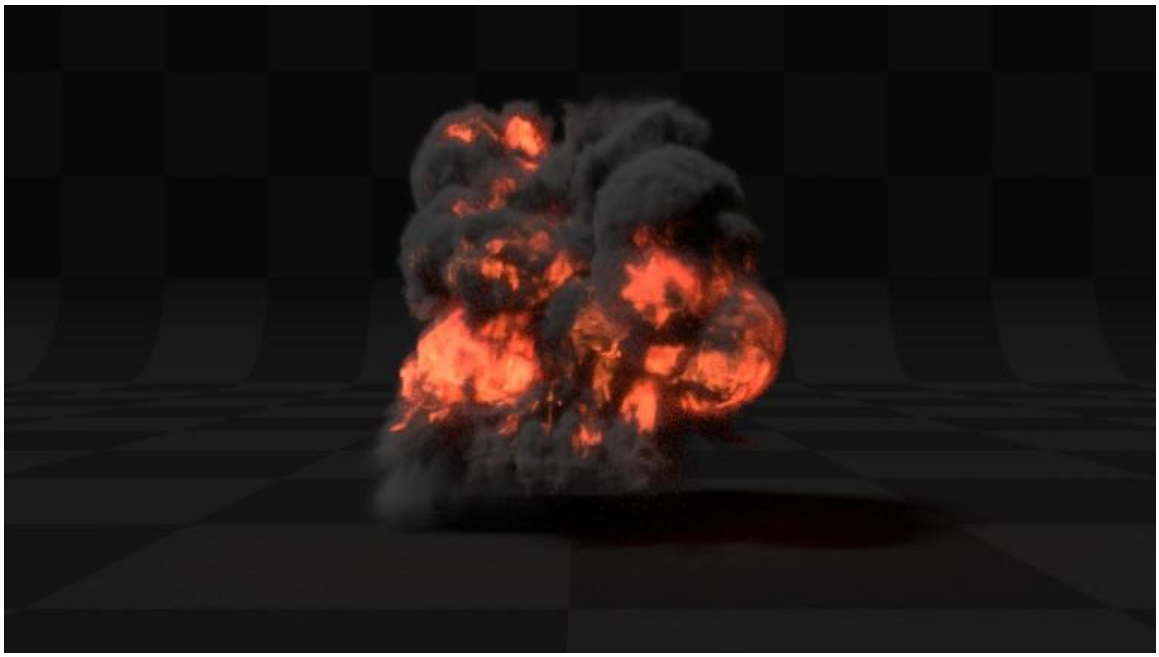

Figure 2.7.1: Smoke Simulation

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Particle simulation where thousands of particle are emitted from a mesh object and react with different forces and physics in a specific life span.

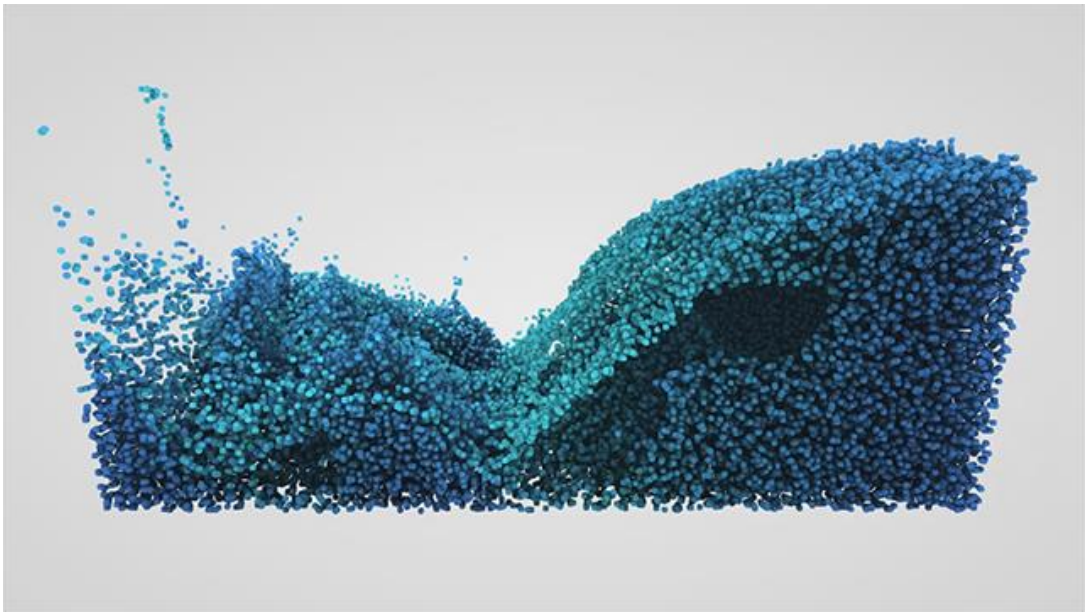

Figure 2.7.2: particle Simulation

Fluid physics are being used to simulate the water simulation properties.

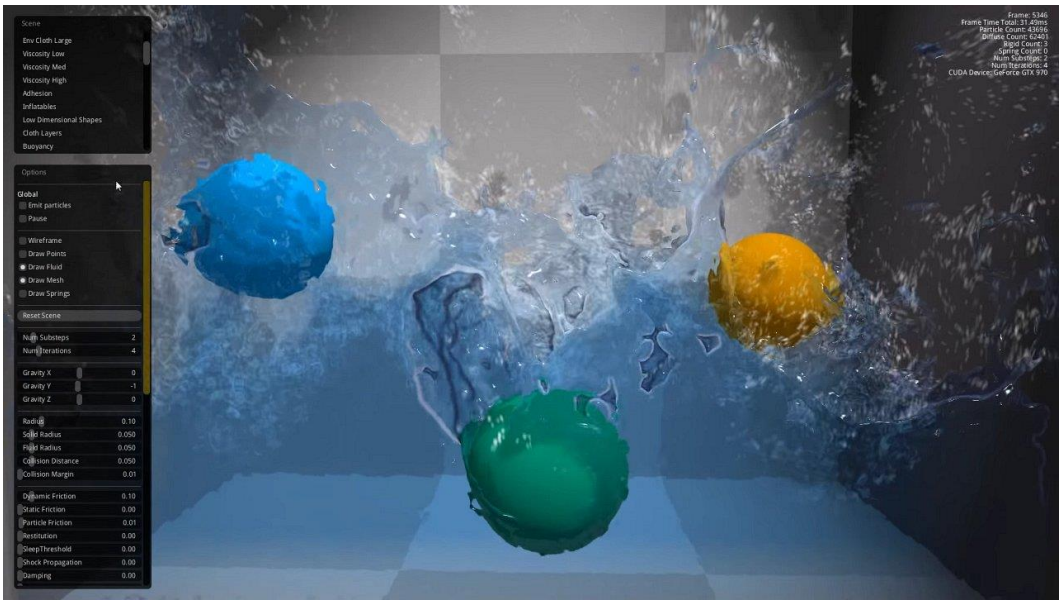

Figure 2.7.3: fluid Simulation

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CHAPTER – 3

Modelling

3.1 Introduction:

In CGi 3D modeling is a technique that uses to create a 3Dimensional object with the help of 3d software. Artists make a 3d model by manipulating the state of the basic shape or deforming the mesh to desired model with the help of different 3d software's. Every 3d Model has vertices, edge and face or polygons though which user manipulate 3d object and computer calculate those so give user desire shape. clean tropology also needed model to look realistic.

We have used polygon modelling technique at our modelling on this project.at the advert is about mobile phone. We had to make models like phone, jet, charger, buildings which was done in Autodesk Maya 2018 and cinema 4d r19.

3.2 Modelling procedure:

Our target was to be maintain the tropology of the models clean so that our model looks real. We used polygon cube to start making our model phone with the help of reference image of out inspired mobile phone model.

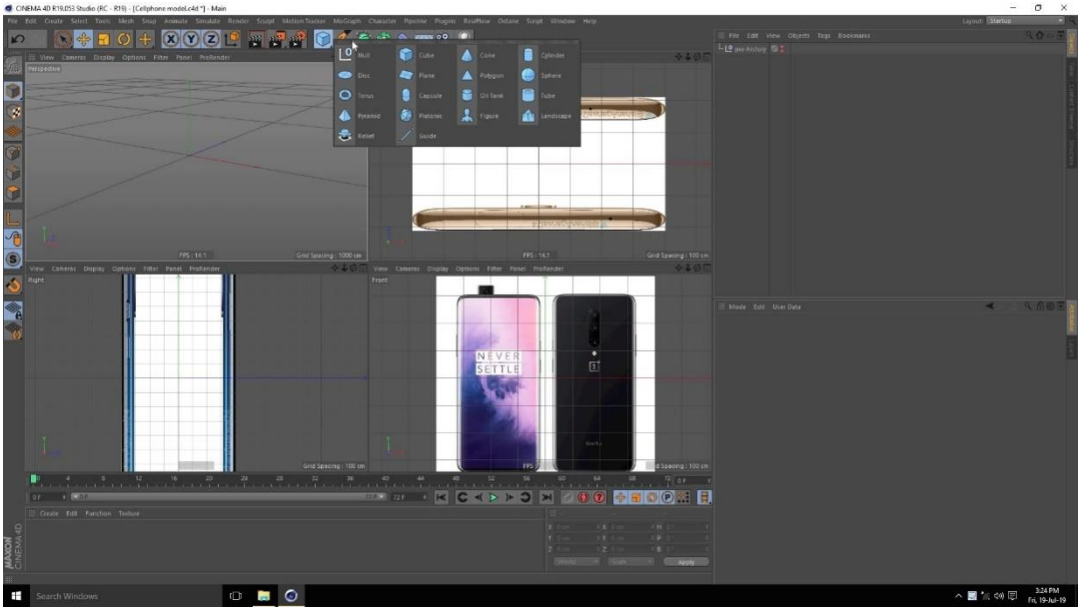

Figure 3.2.1: setting refence image for modelling

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Took a cube and scaled it with the shape of reference image phone

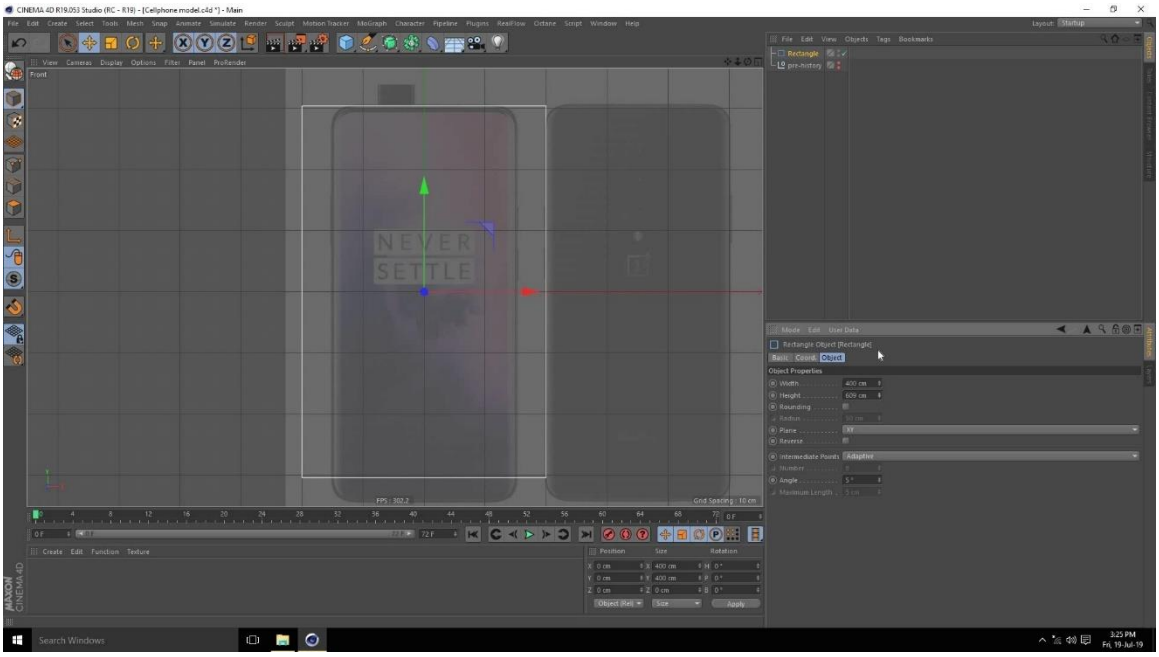

Figure 3.2.2: adjusting polygon box shape

The box has given the shape of the mobile phone seeing the reference image.

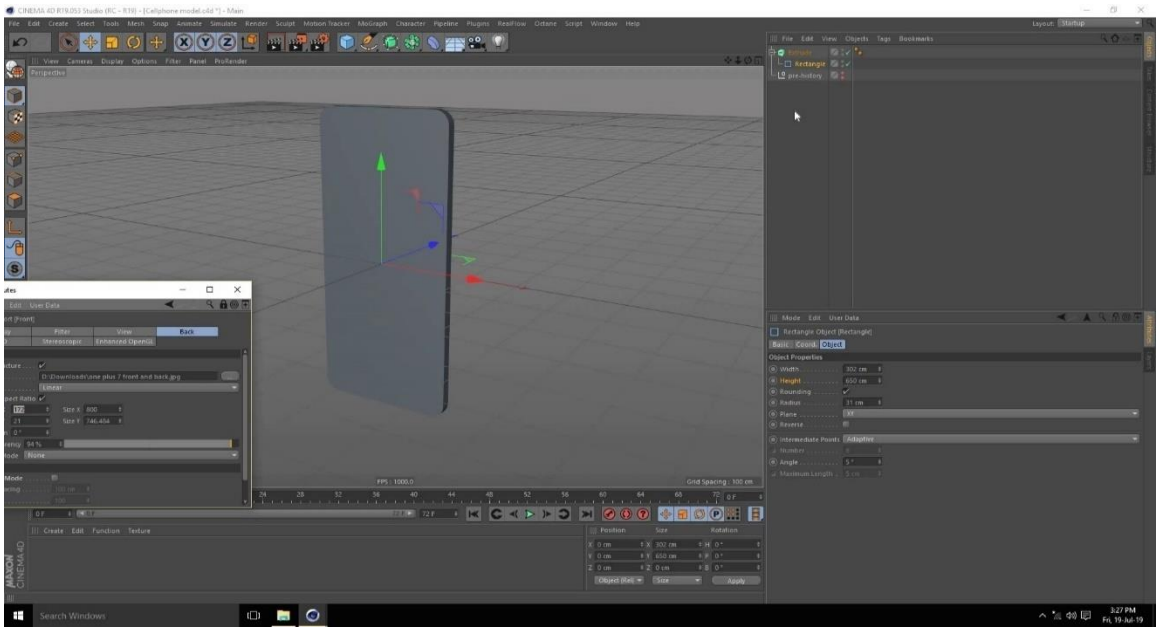

Figure 3.2.3: Polygonal cube to mobile shape

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Beveling the edges of cube to get the roundish smooth corners of the mobile phone

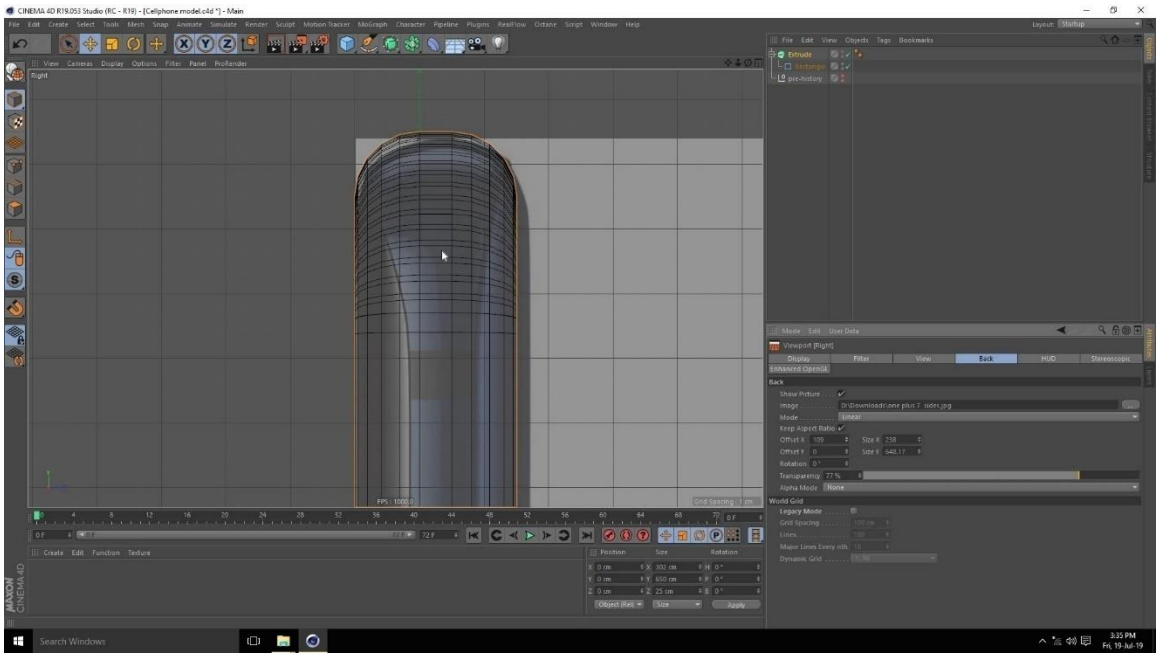

Figure 3.2.4: beveling edge of cube

Similar way making the screen glass of the phone from the cube

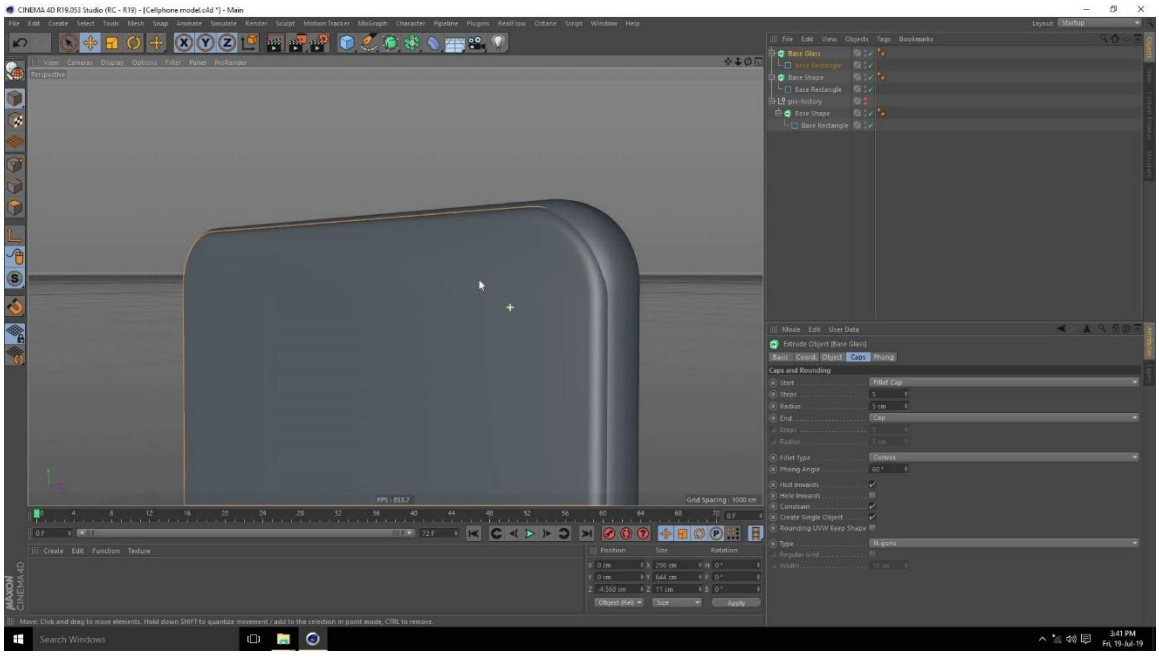

Figure 3.2.5: making screen of phone

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Checking the glass of screen by rendering a frame in cinema 4d

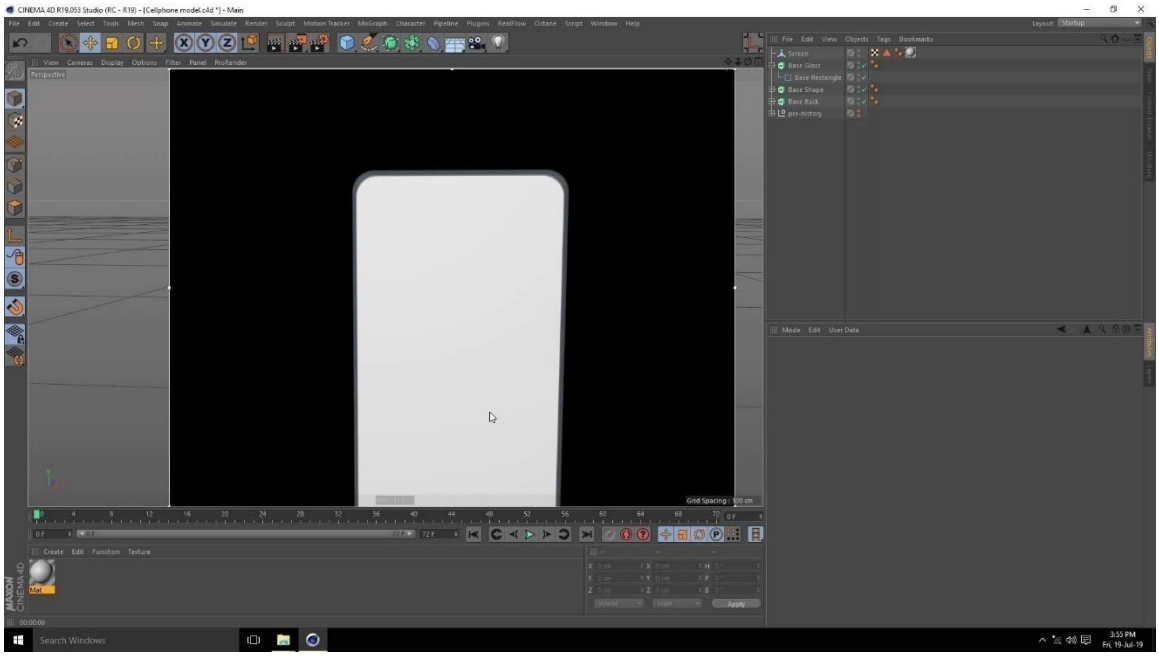

Figure 3.2.6: test rendering a frame

Making the hole for side button by Boolean technique

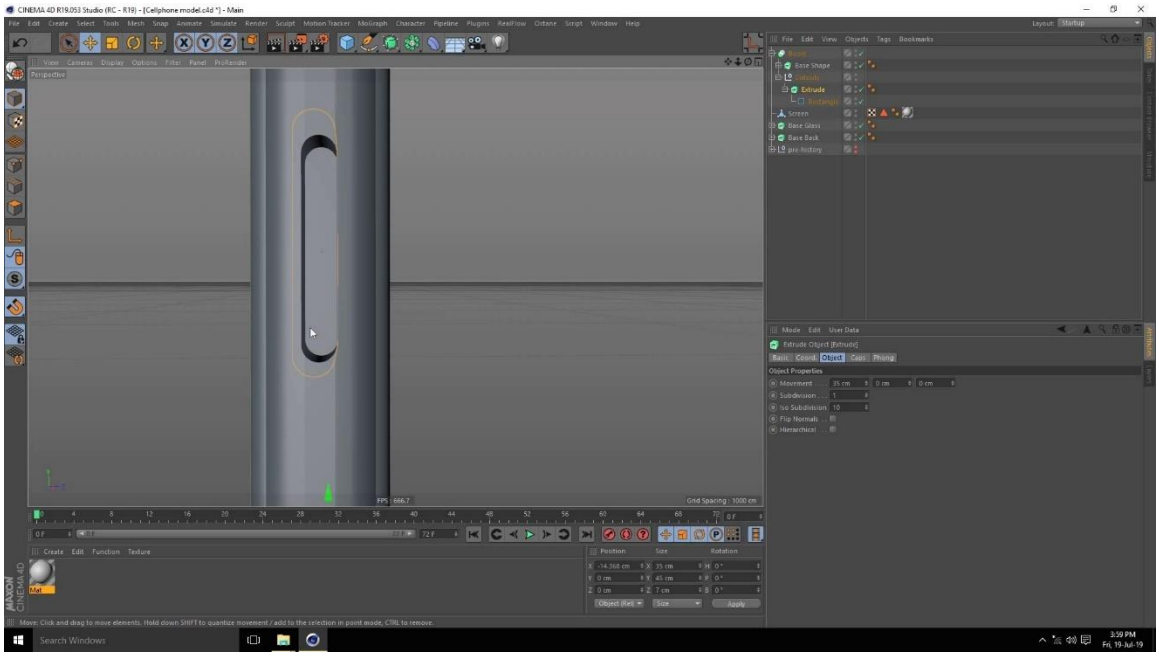

Figure 3.2.4: Making hole for button

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Cutting the corners to and adjusting the vertex to get nice corners of the hole

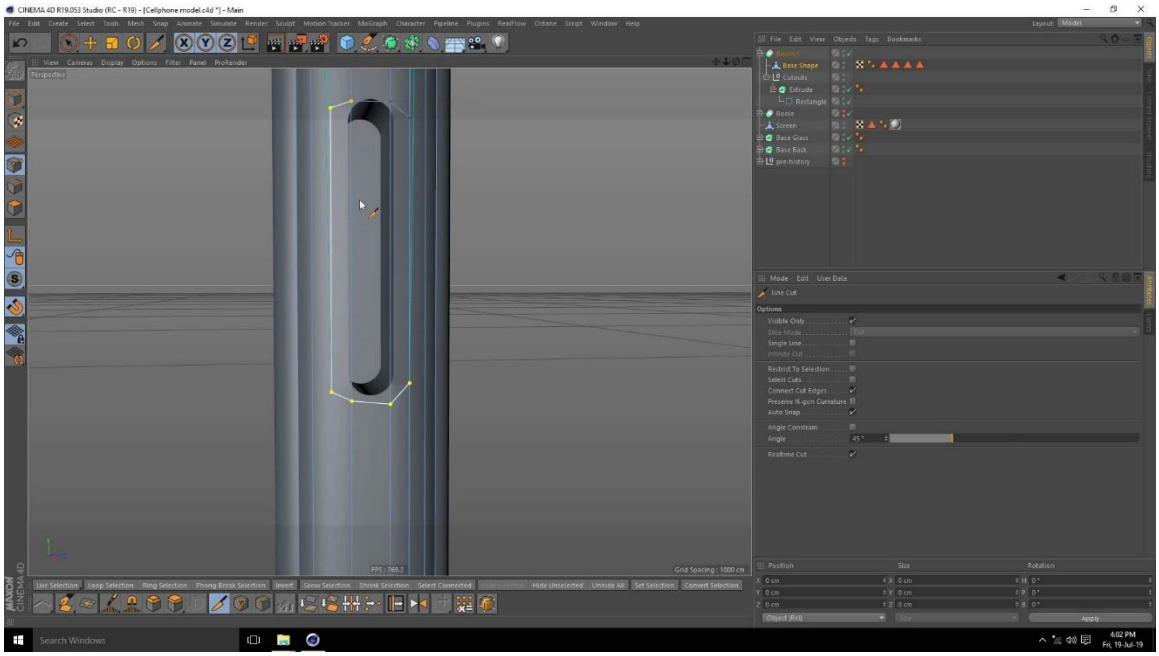

Figure 3.2.5: adjusting vertex of hole

Smoothing the hole to give button inside of the shape

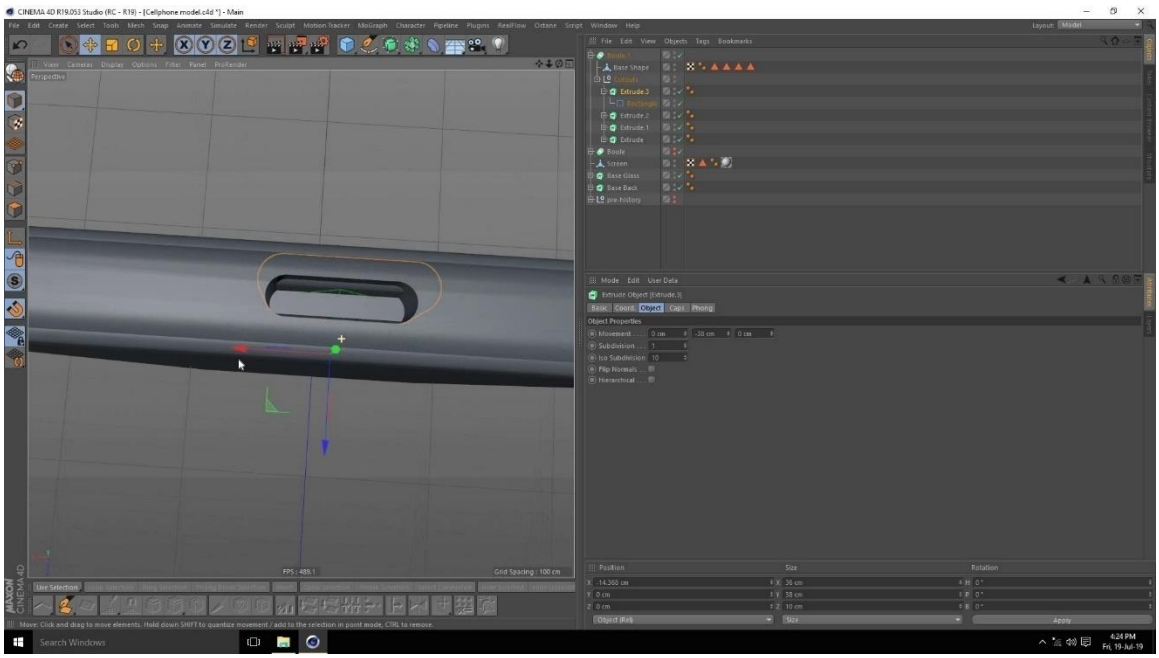

Figure 3.2.6: smoothing whole

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Making hole for the sound box at the bottom of the phone by Boolean method

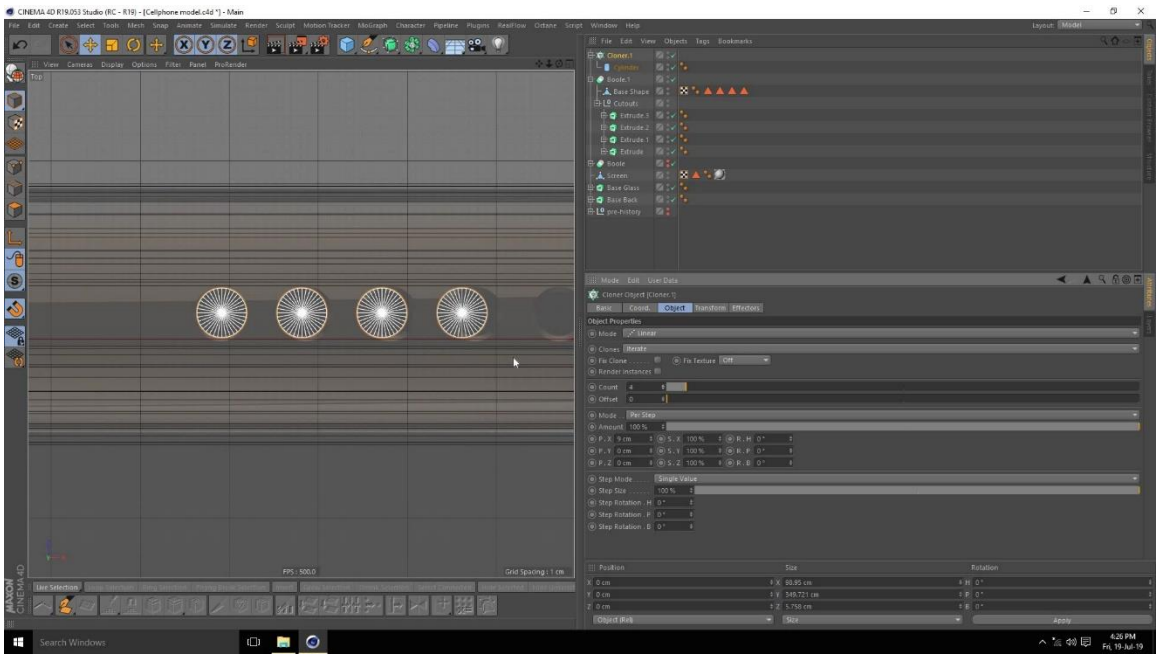

Figure 3.2.7: making sound box hole by Boolean

Similarly making the hole for charger port, microphone port

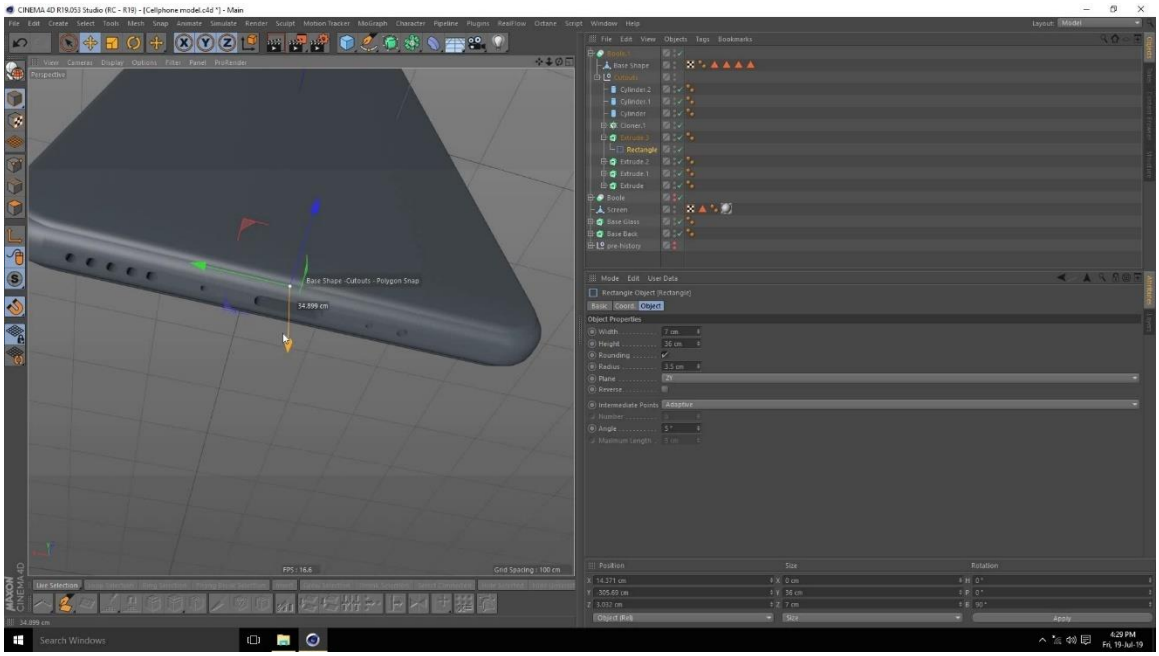

Figure 3.2.8: Modeling Charger, Microphone Hole

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Making sim card slot at the left side of the phone by taking a cube Boolean and bevel

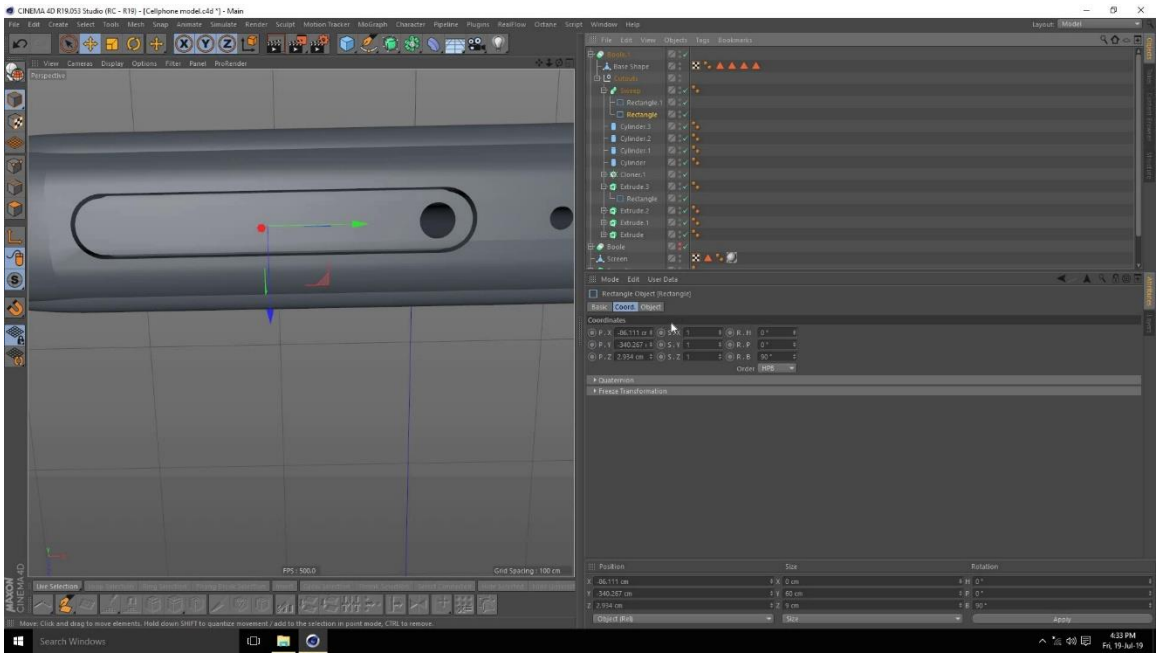

Figure 3.2.9: Modeling the slim card slot

Modeling side lock/unlock button for mobile phone

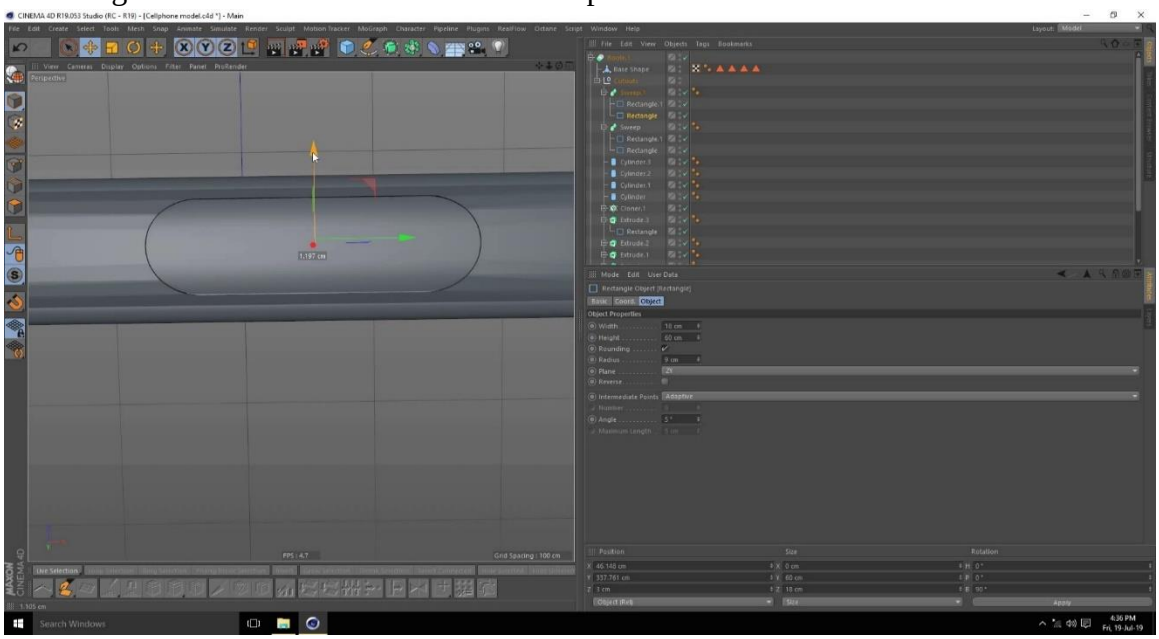

Figure 3.2.10: modeling side buttons

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Making volume button and placing at the hole created earlier

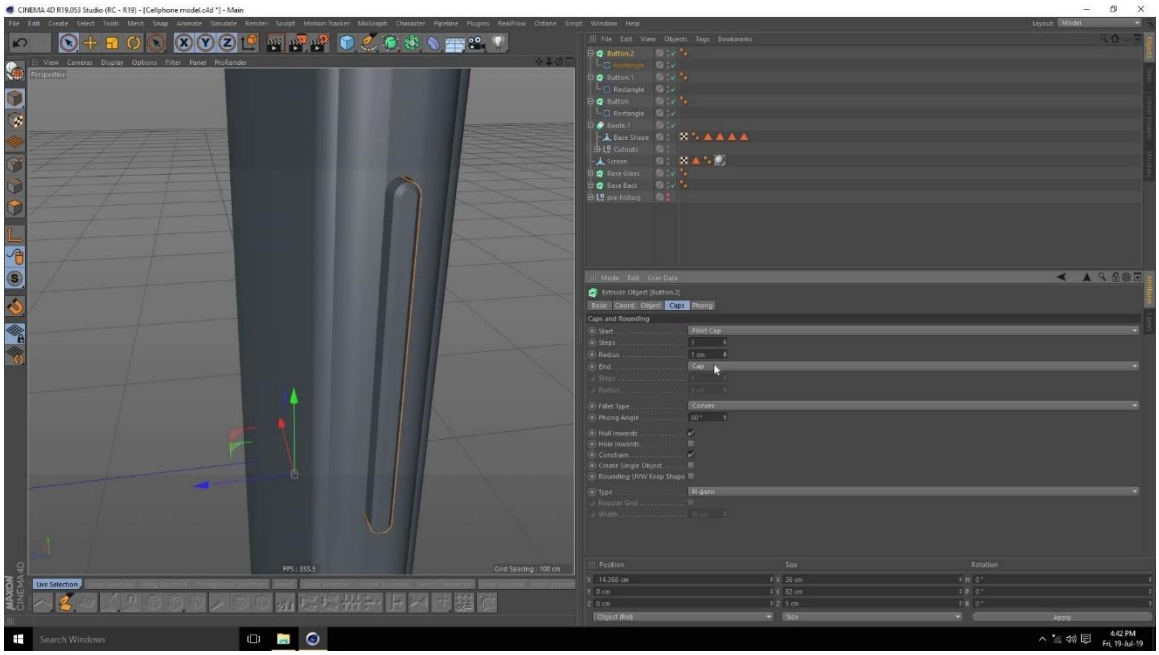

Figure 3.2.11: modeling volume button

Used cube and sphere for creating pop up camera and used tool bevel and Boolean.

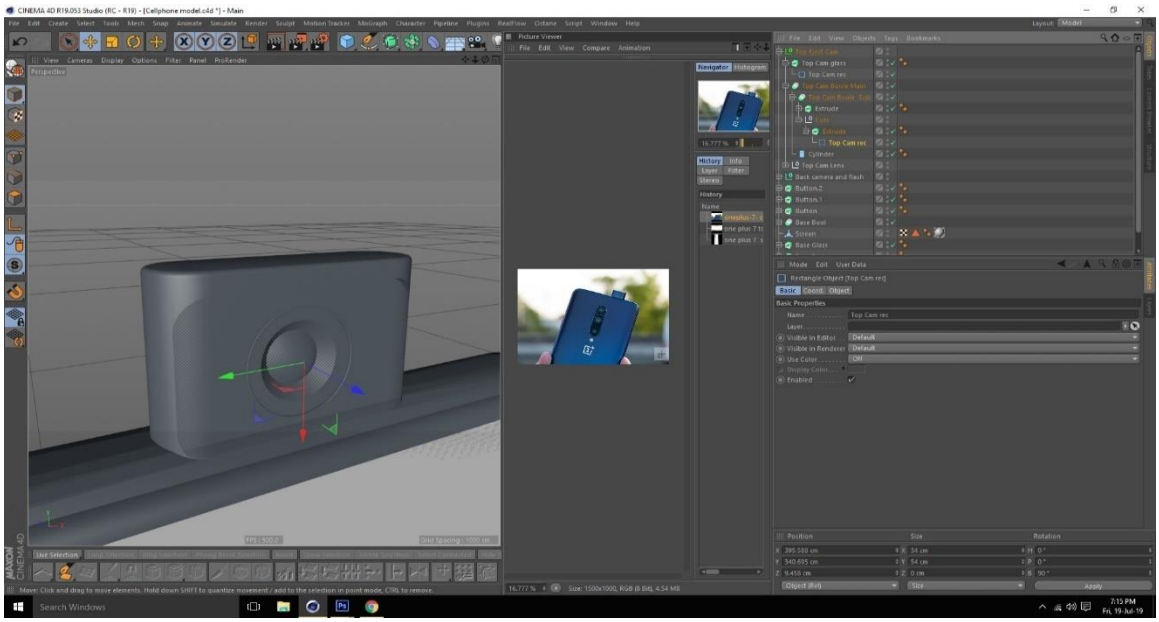

Figure 3.2.12: making popup camera

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Then back camera is modeled by the same techniques and was time consuming and more detail than any other mobile pars

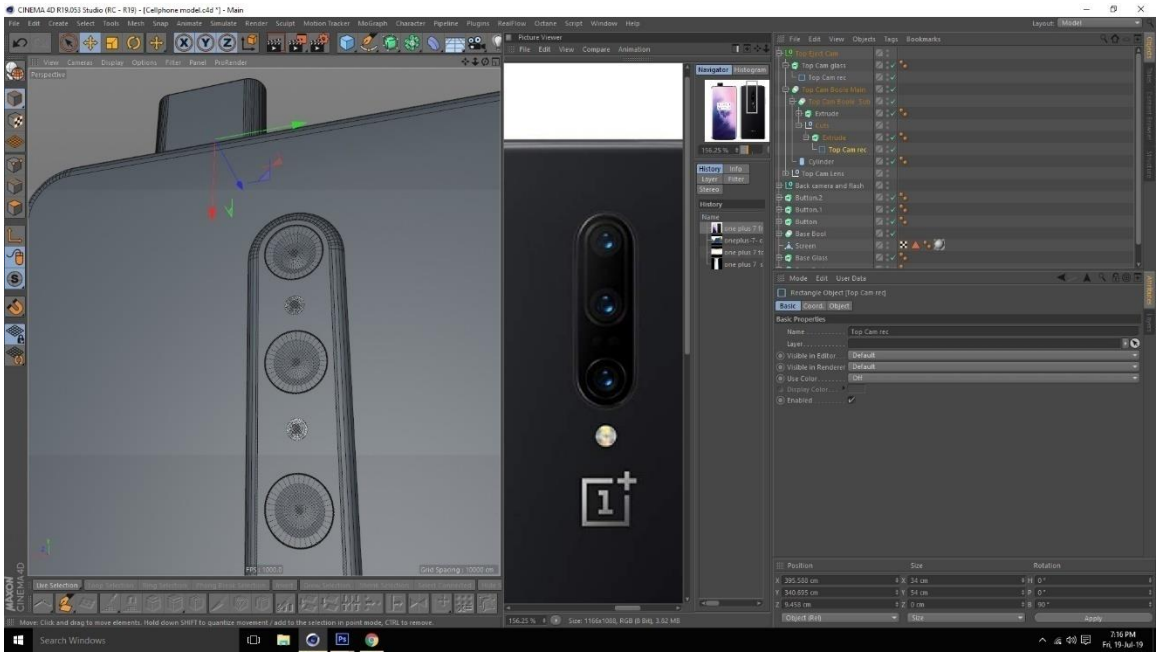

Figure 3.2.13: Back camera model by reference

Making more details part of camera with tube, cylinder for making the internal parts of camera

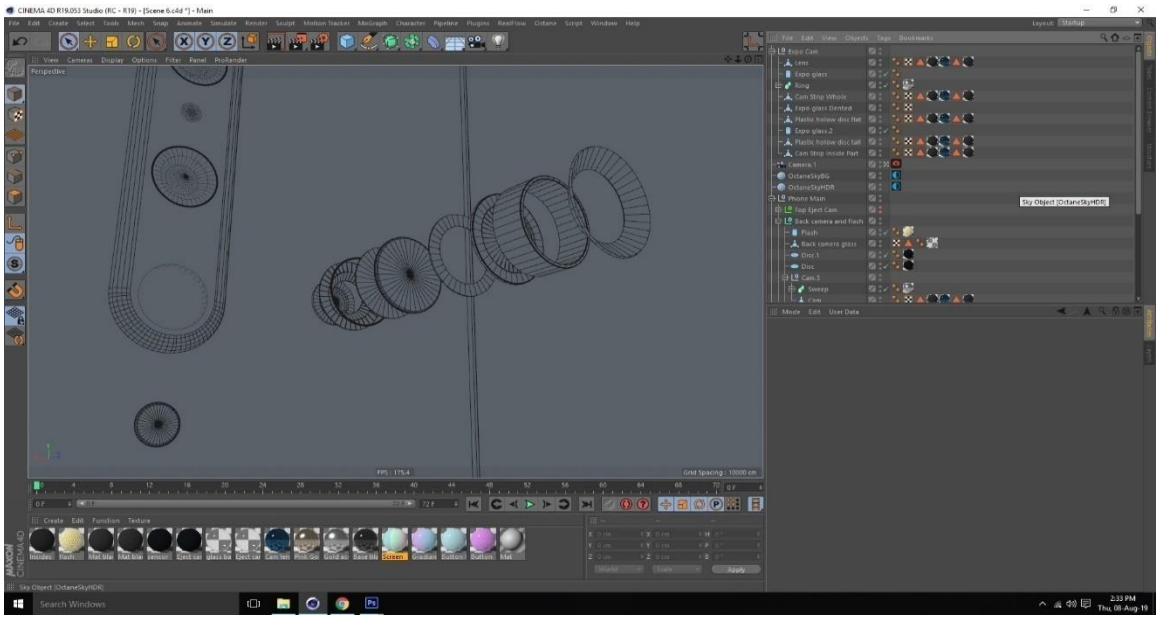

Figure 3.2.14: High details of back camera parts

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This part is about building the models of building. this easy process as we have to take a cube and just Extruding and inner Extruding the surface to give building look

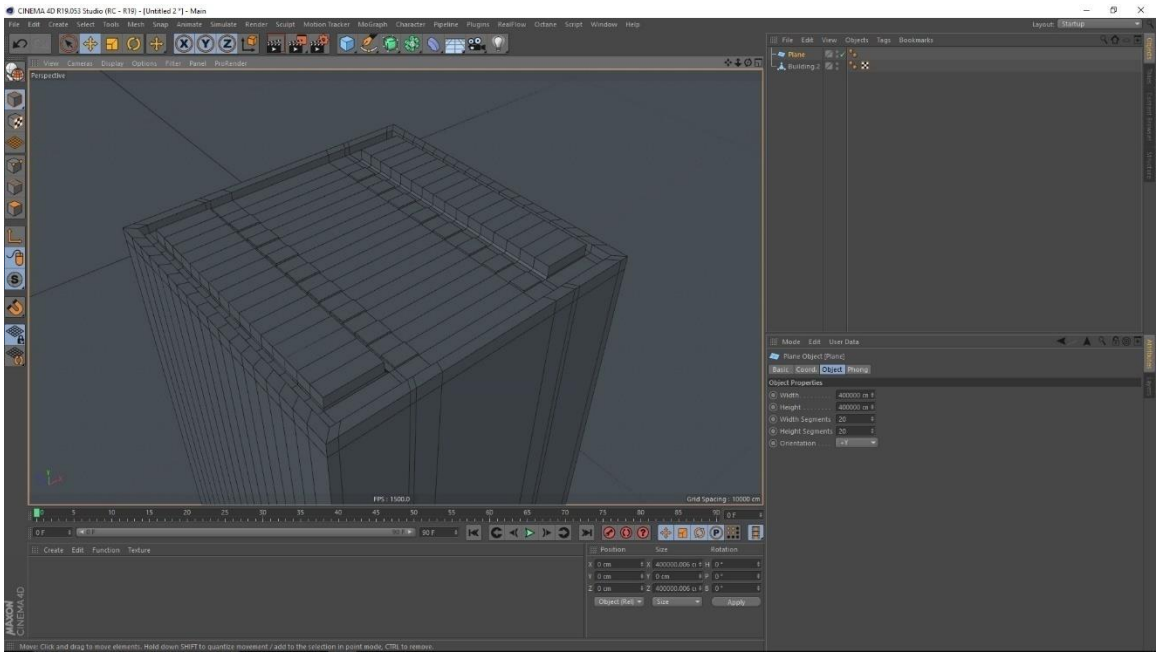

Figure 3.2.15: making building From cube

Making more details about the building to make different shaped building

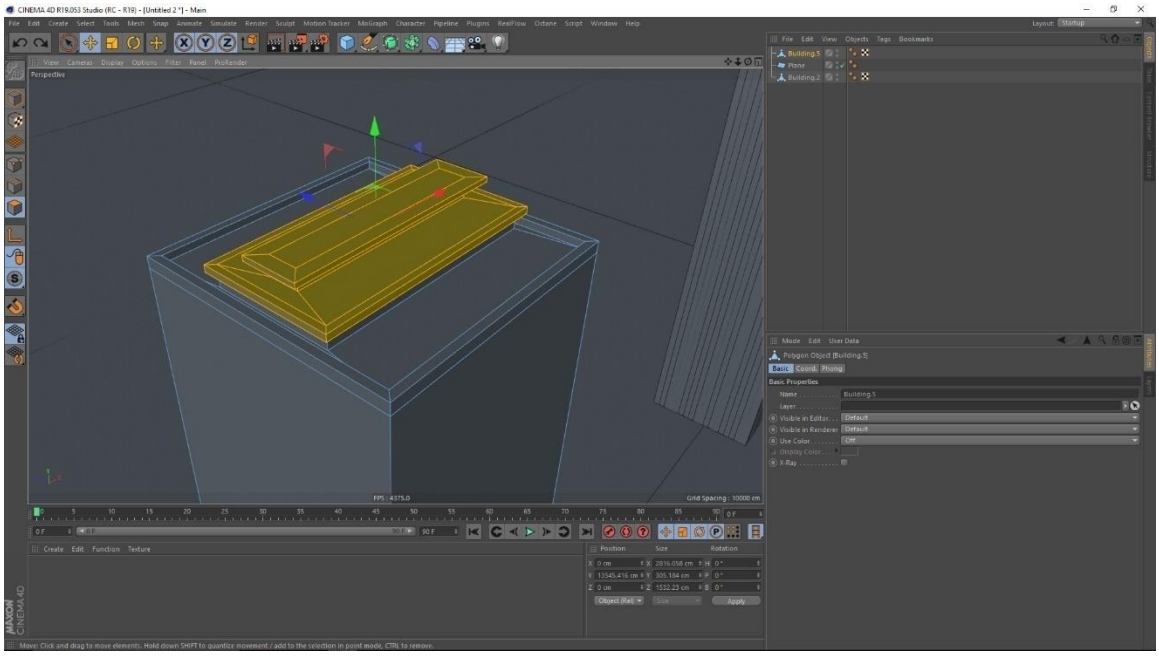

Figure 3.2.16: Making different type of building

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Made different looking buildings to create variety of models and scene doesn't look flat

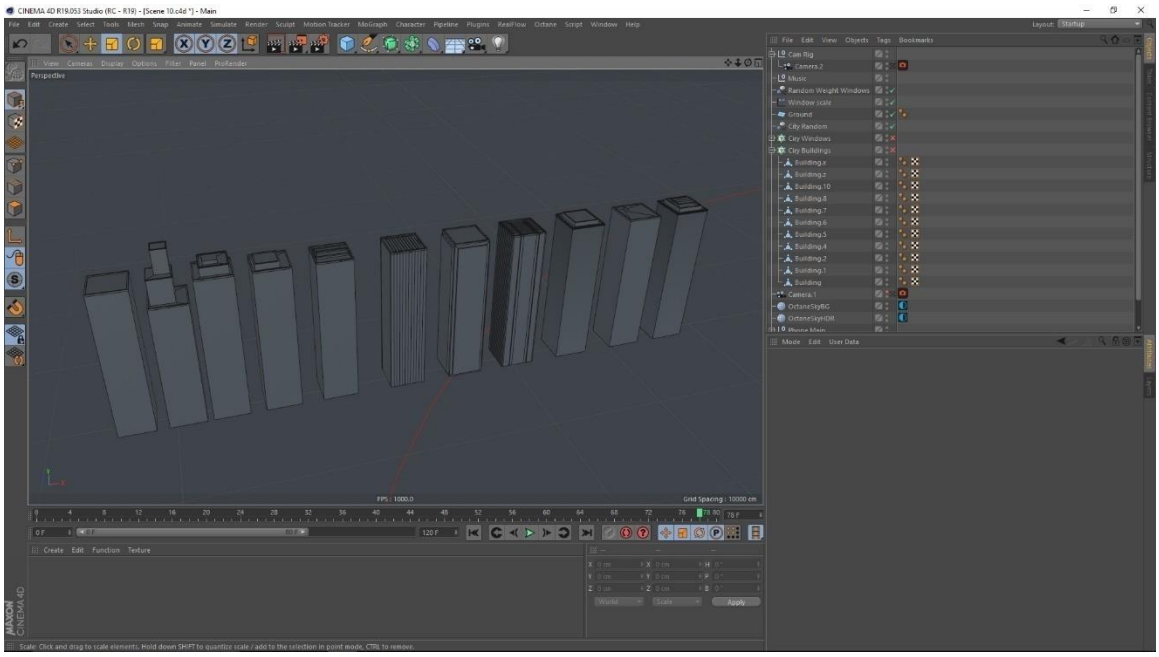

Figure 3.2.17: Making different type mobile

Making a lot of building with the help of array in mograph which has a special type of dynamic effectors for creating dynamics.

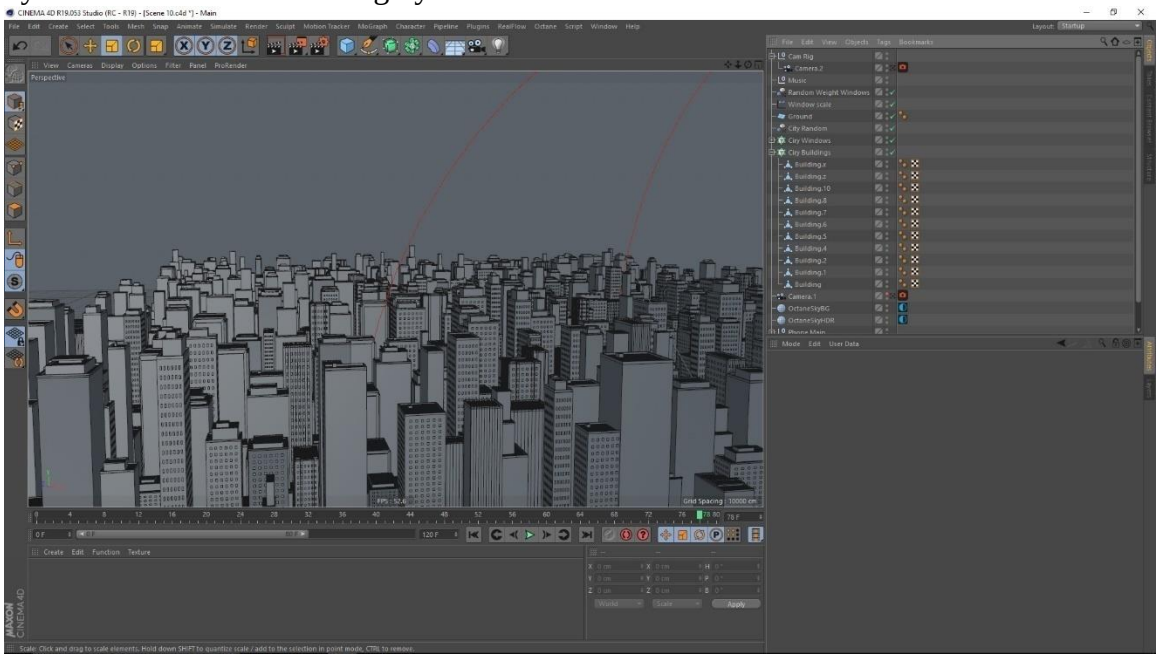

Figure 3.2.18: making building city with mograph

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CHAPTER – 4

Lighting

4.1 Introduction:

Lighting was crucial part of our project, we had to use lighting for our product and other scenes. Image based lighting was our primary light source in maximum scene for which we used hdris images.

4.2 Lighting Procedure:

This HDRI map is used in our maximum scene for lighting

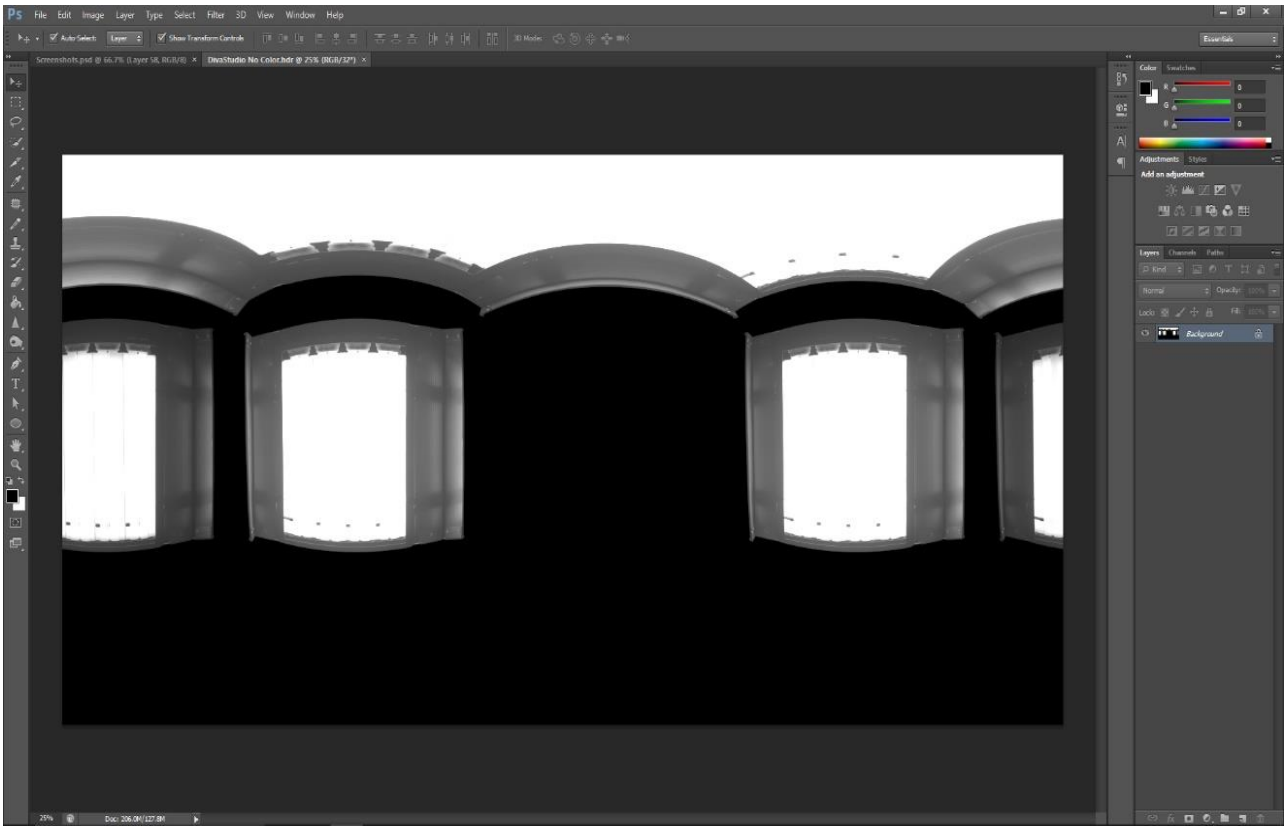

Figure 4.2.1: HDRI MAP

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Octane sky hdr map is adjusted in this scene for getting reflection and light bounces

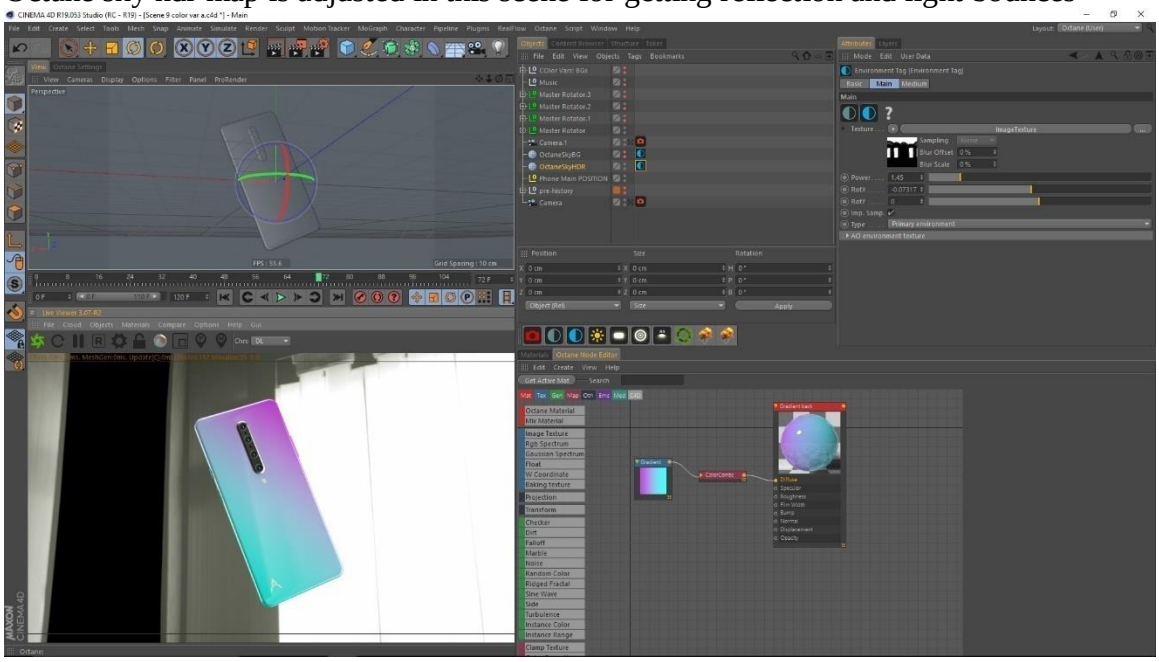

Figure 4.2.2: Octane Sky hdri adjusted

A frame is rendered to show the effects of map

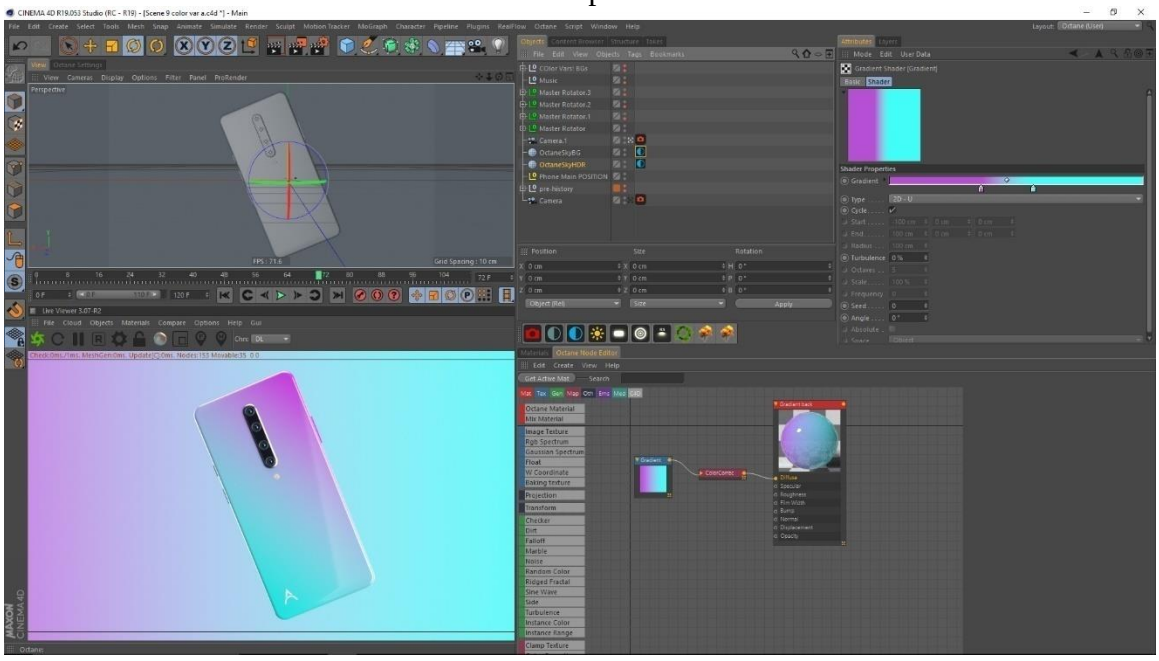

Figure 4.2.3: Octane sky hdr test render

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Hdri map parameter is tweak to get that desire look

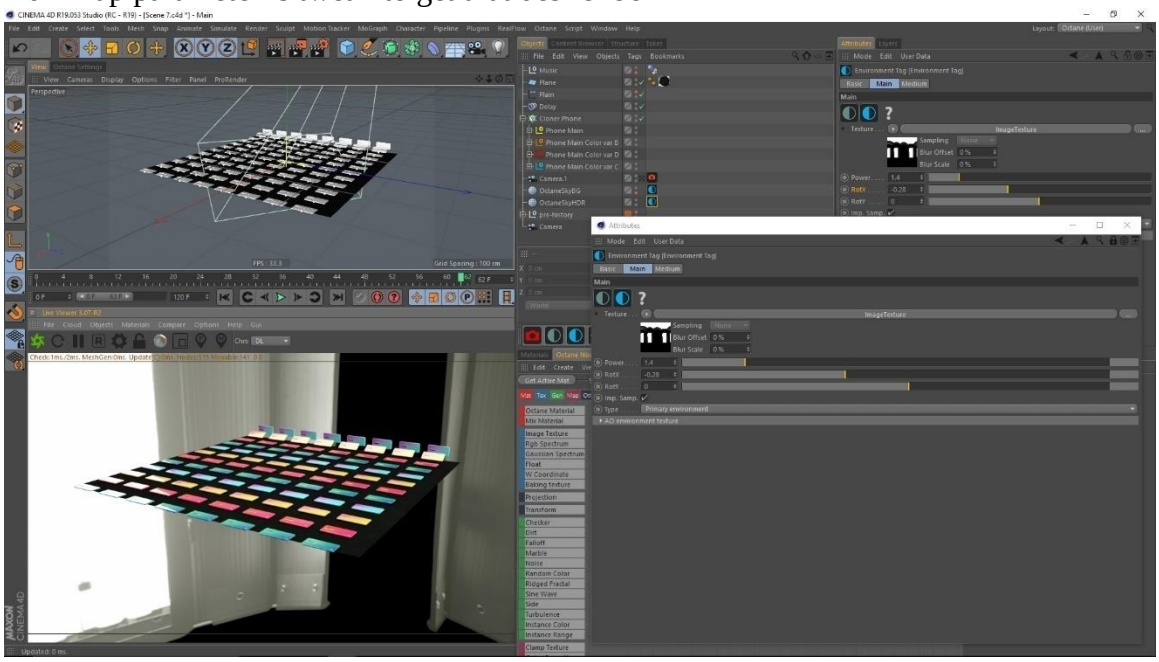

Figure 4.2.4: tweak Octane sky Hdr

Test Rendering a frame under the hdri map to see the intensity and reflection on the object

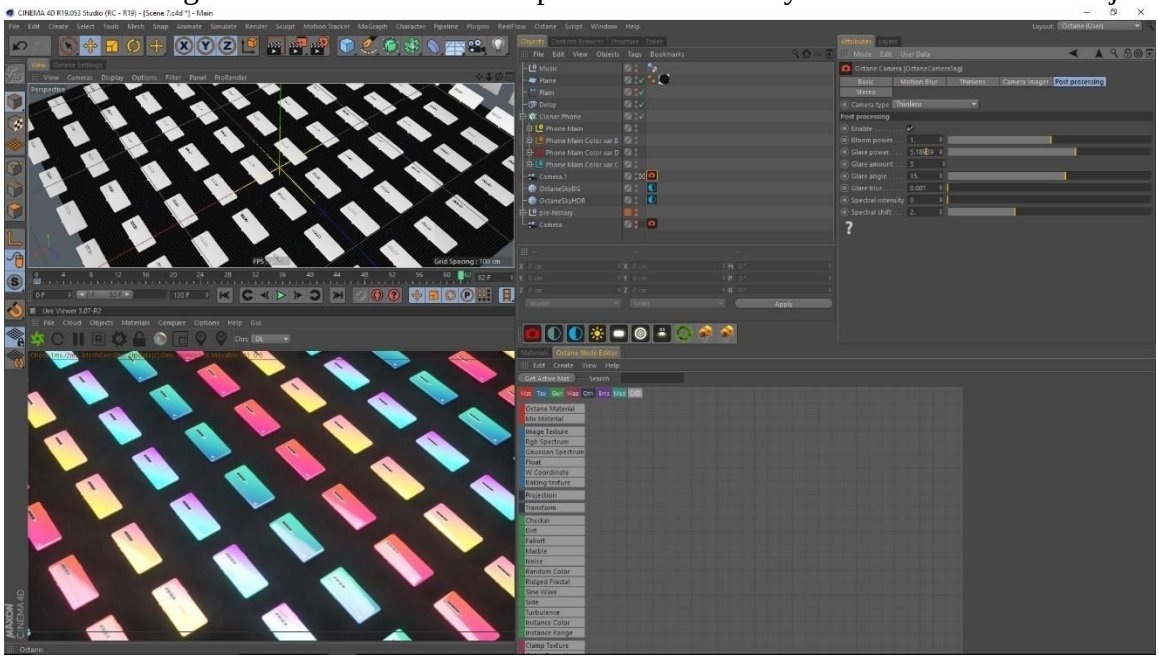

Figure 4.2.5: Octane sky hdr Test render

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Testing just the light pass.

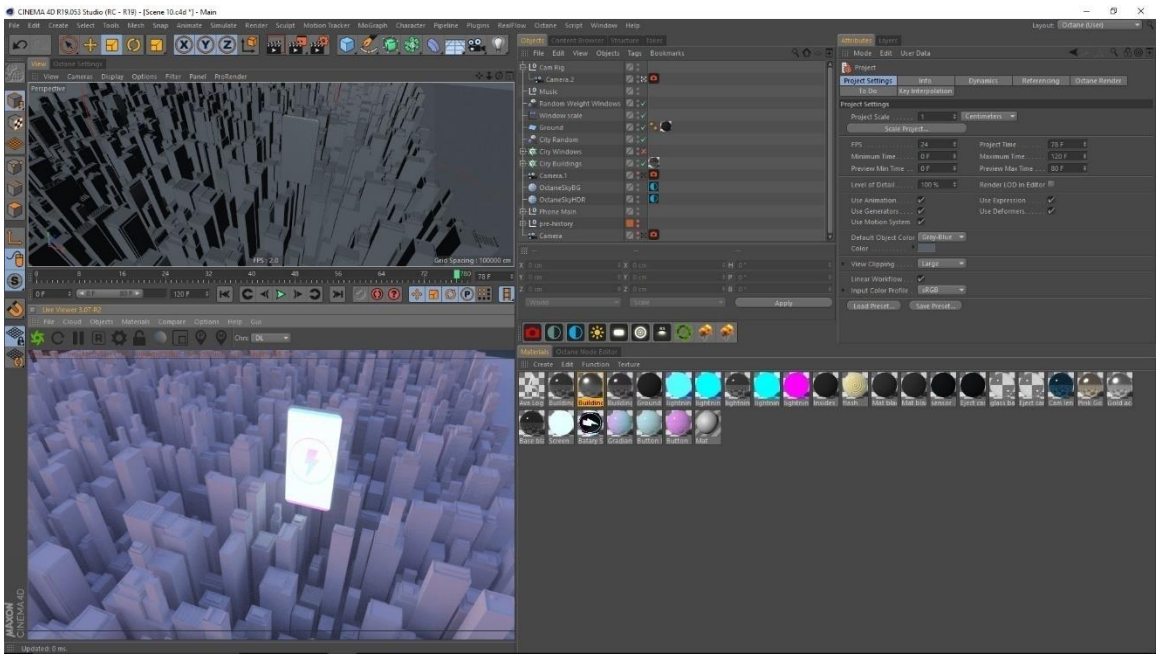

Figure 4.2.6: Render without Hdri map

Completing lighting with basic materials without luminance.

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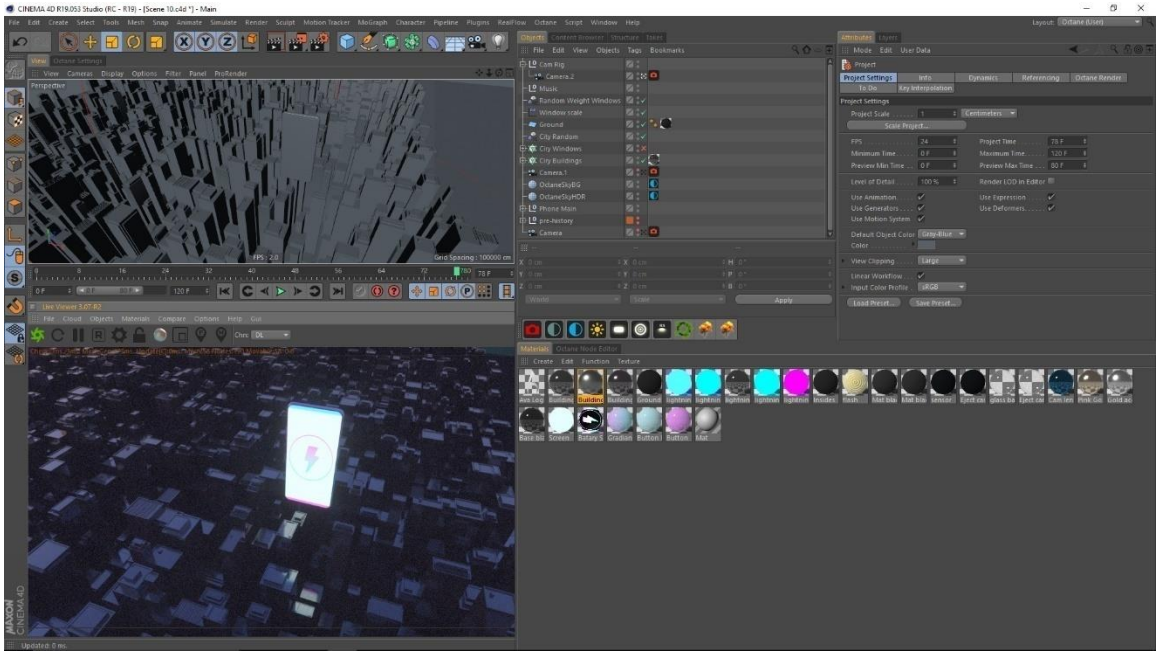

Figure 4.2.7: Render with Hdri map

Giving the lighting material to the windows of building

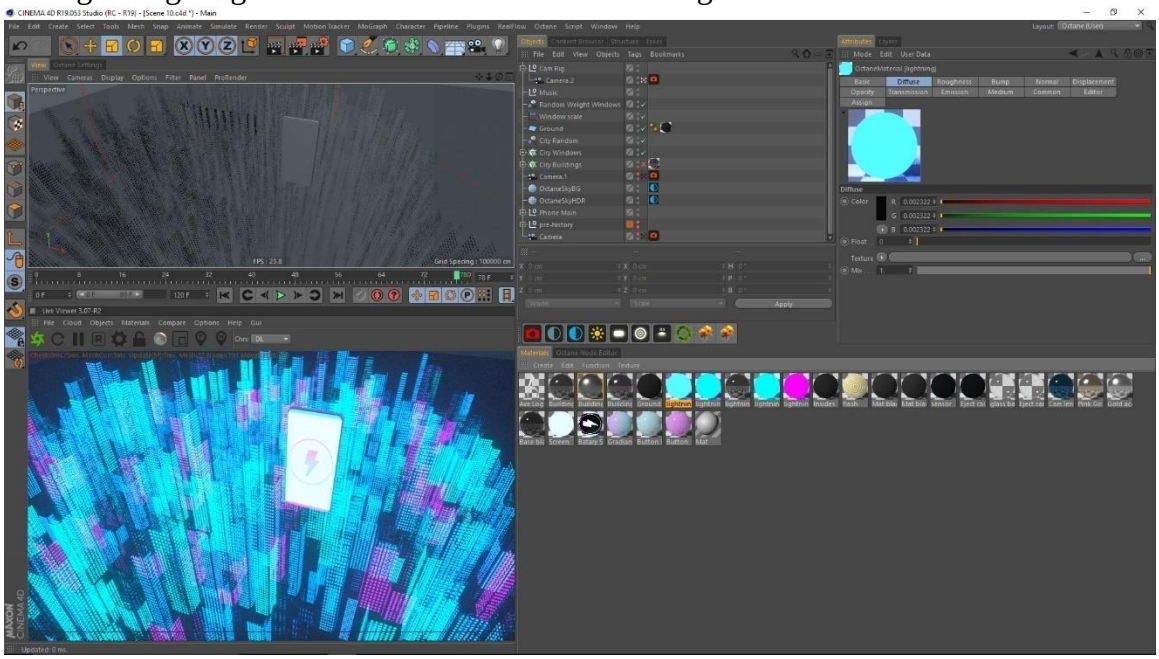

Figure 4.2.8: lighting the windows

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Viewing the final light with building on.

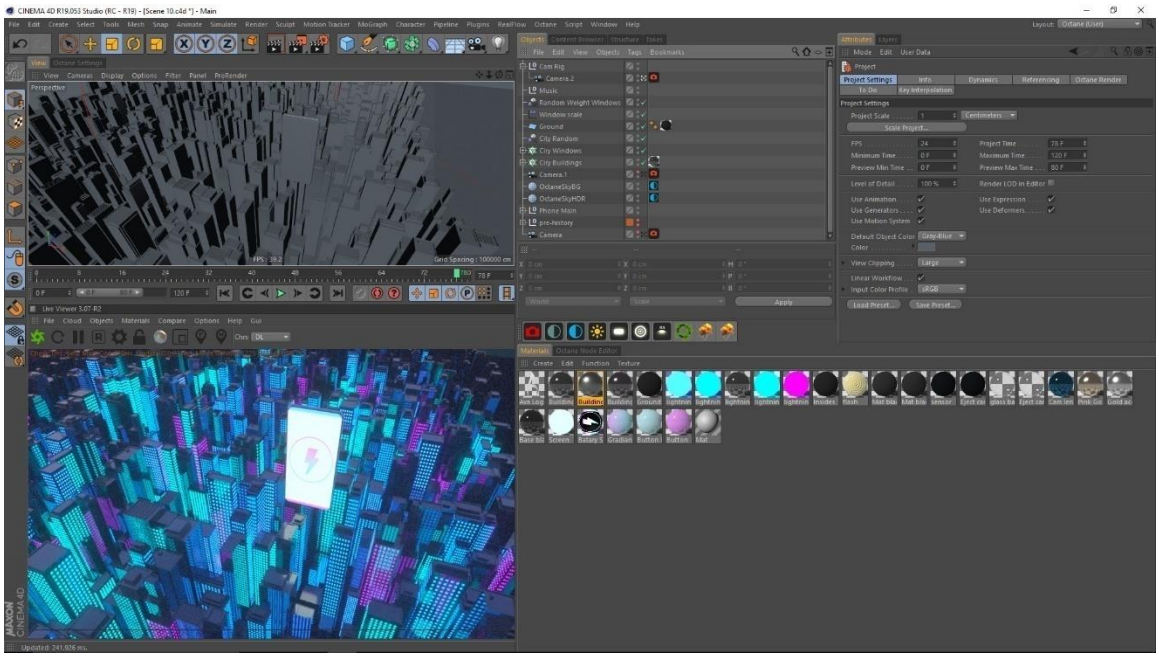

Figure 4.2.9: lighting with buildings and windows

Flat lighting of the scene rendered

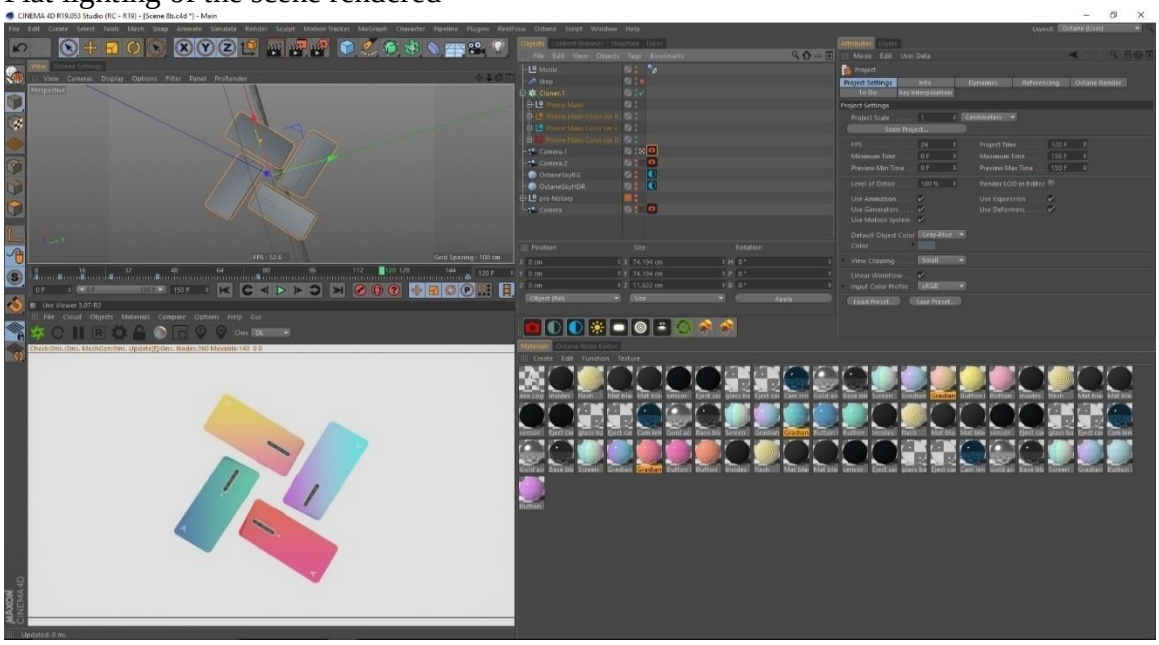

Figure 4.2.10: flat render of lighting

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Adding octance sky Hdr to the scene

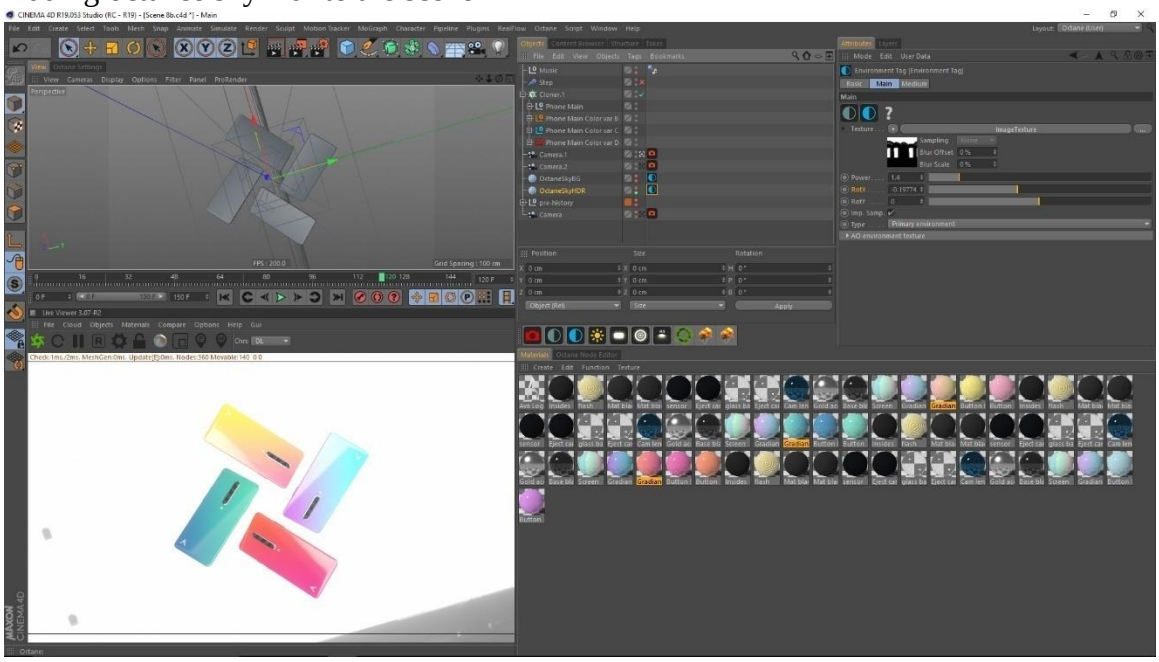

Figure 4.2.11: Hdri map added

Rendering the scene with the hdri and background color on the plane

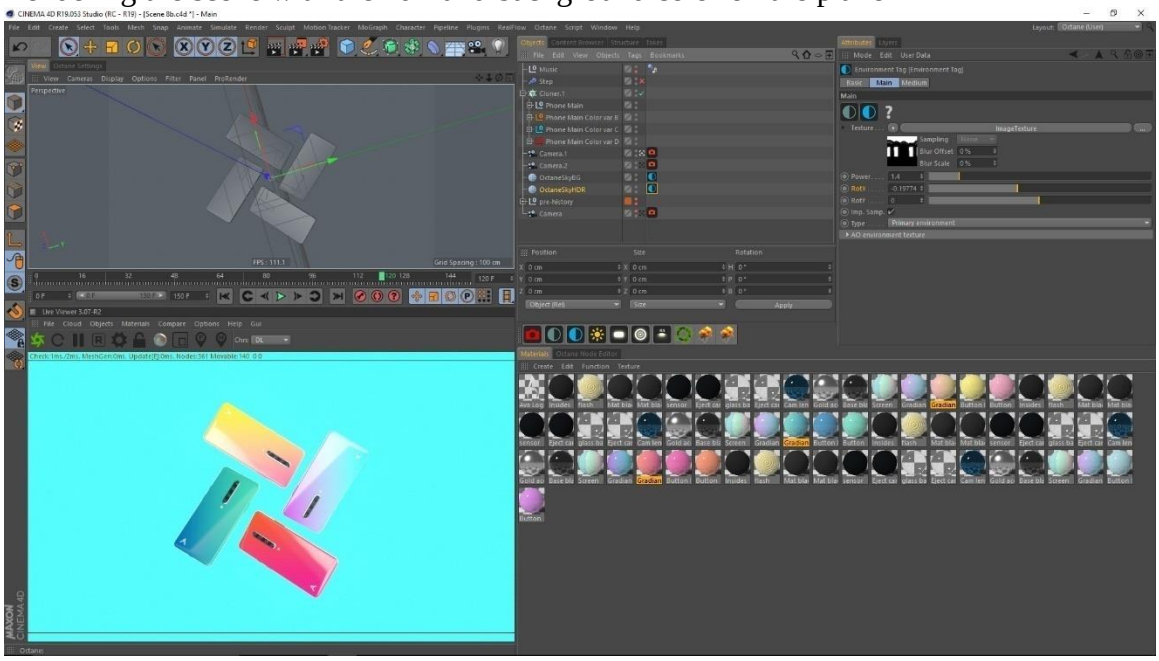

Figure 4.2.12: Rendering the scene

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Flat render of the scene with just the reflection of glasses on body surface

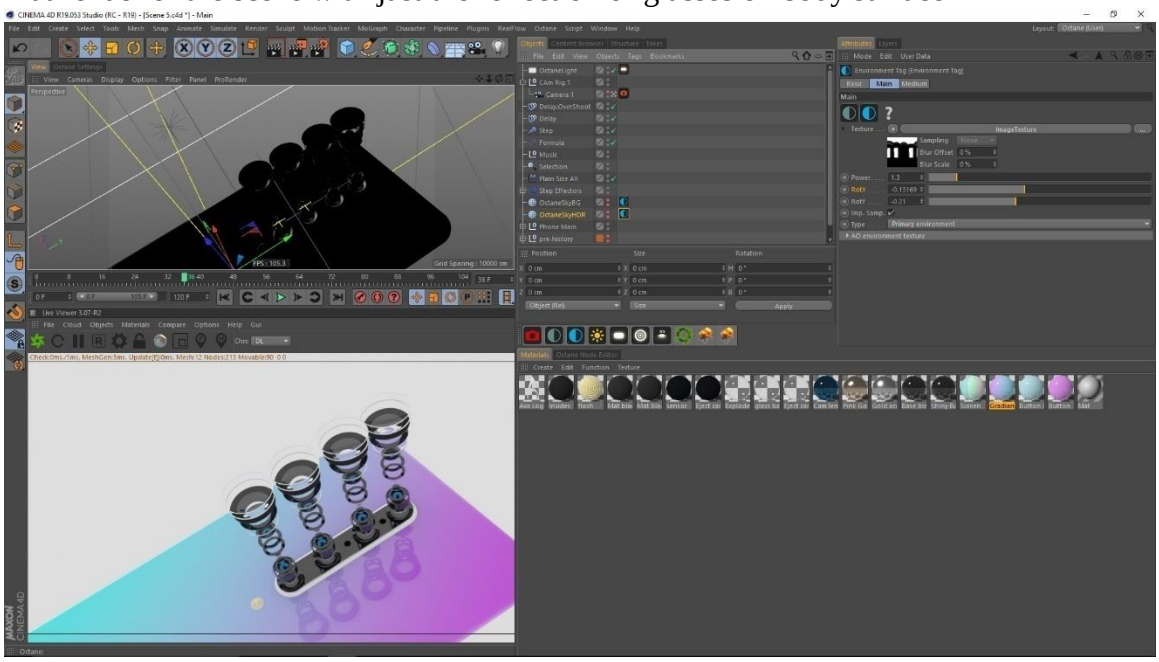

Figure 4.2.13: flat render of scene

Adding the Hdri map makes the scene look more realistic, give the studio and premium vibe

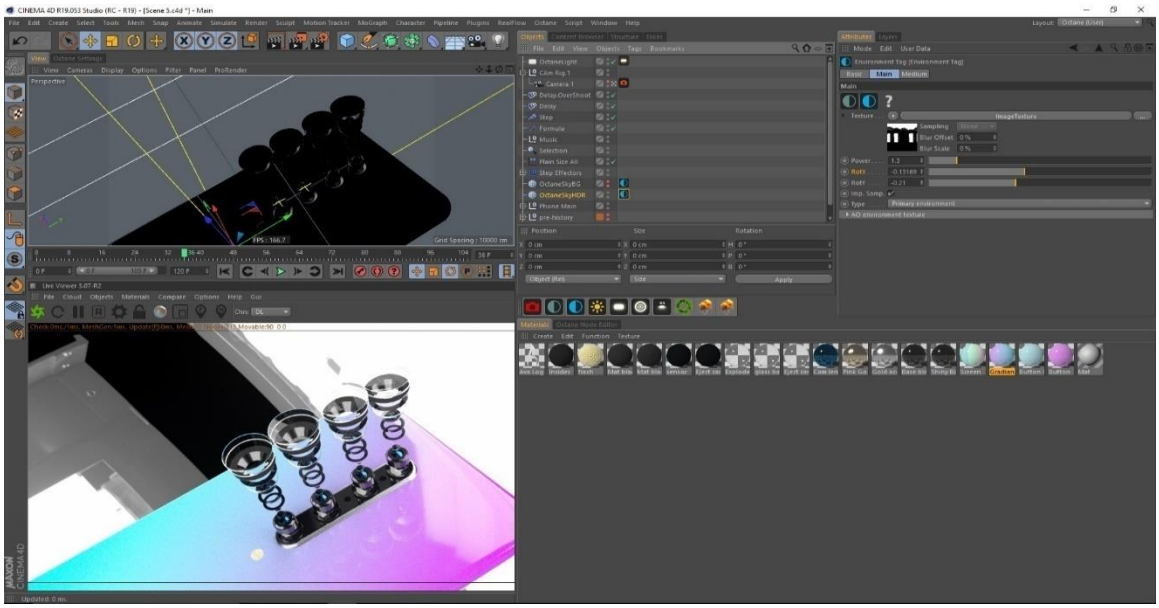

Figure 4.2.14: Hdri map to make scene realistic

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Added a background of gradient color to continue out our theme for the project

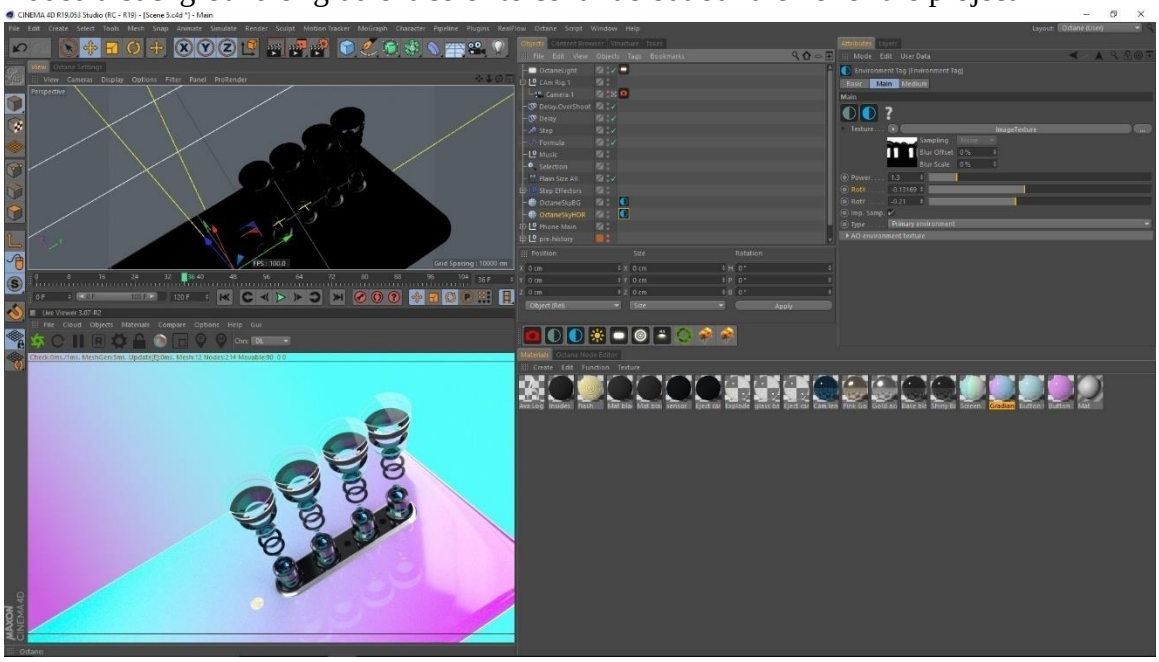

Figure 4.2.15: render with gradient background

Default Normal render of the scene

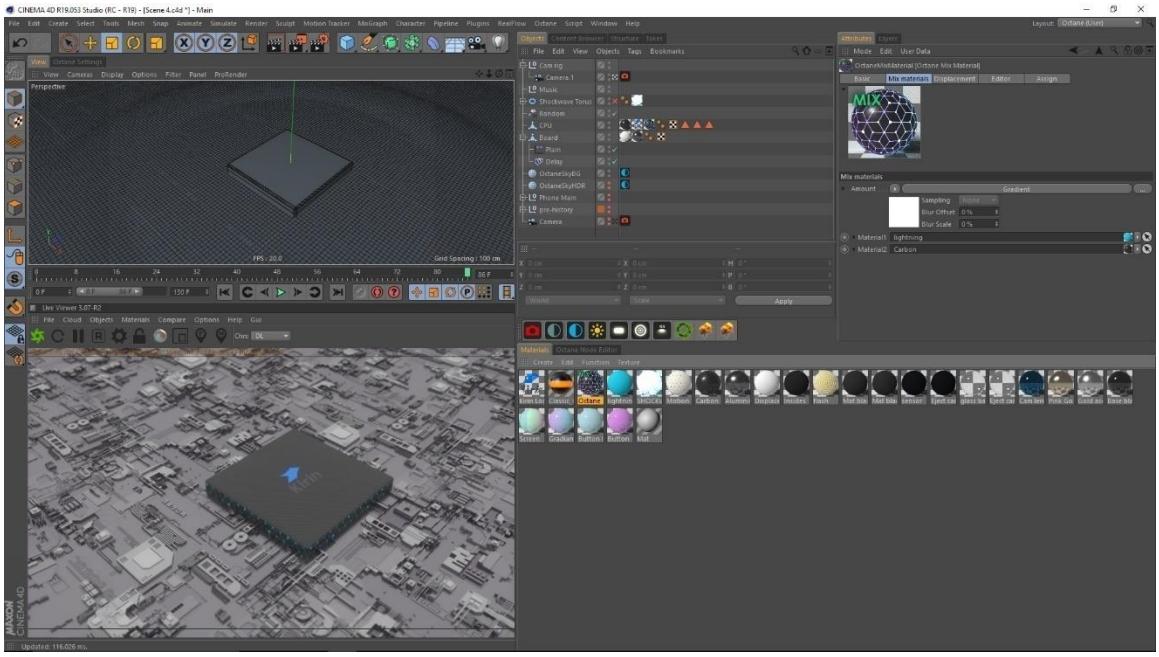

Figure 4.2.16: processor default render

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Turning on Hdri map.

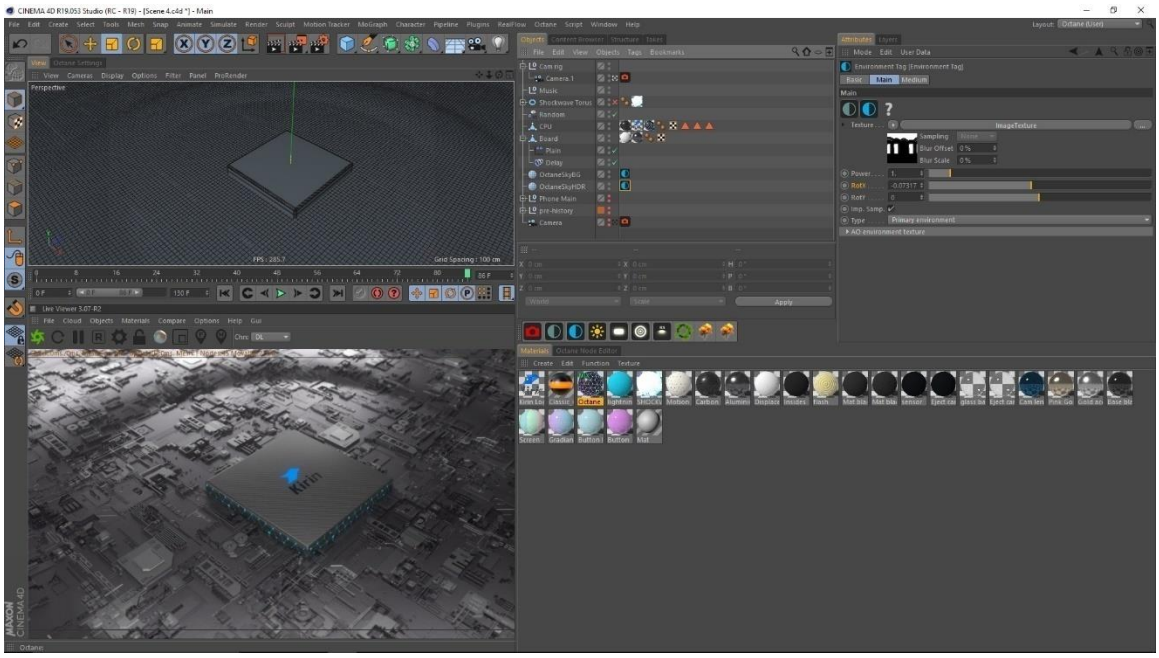

Figure 4.2.17: processor with hdri map render

Here the scene is render with all the material turned on and final look of the scene with hdri map and material color

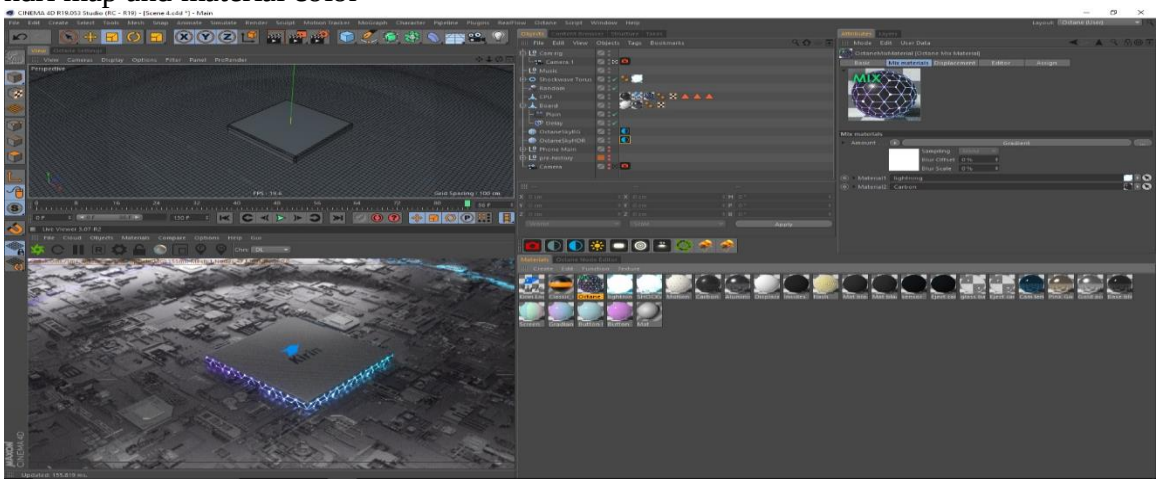

Figure 4.2.18: final render of scene

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CHAPTER – 5

Fx And Simulation

5.1 Introduction:

I created various fx using cinema 4d's mograph module. Which was used for both scene creation and animation purposes. Some smoke simulation was done using Turbulence fd for creating some effects.

5.2 Fx And simulation procedure:

Created the shape with the help of sweep subdivision surface to created that round shape for the tunnel

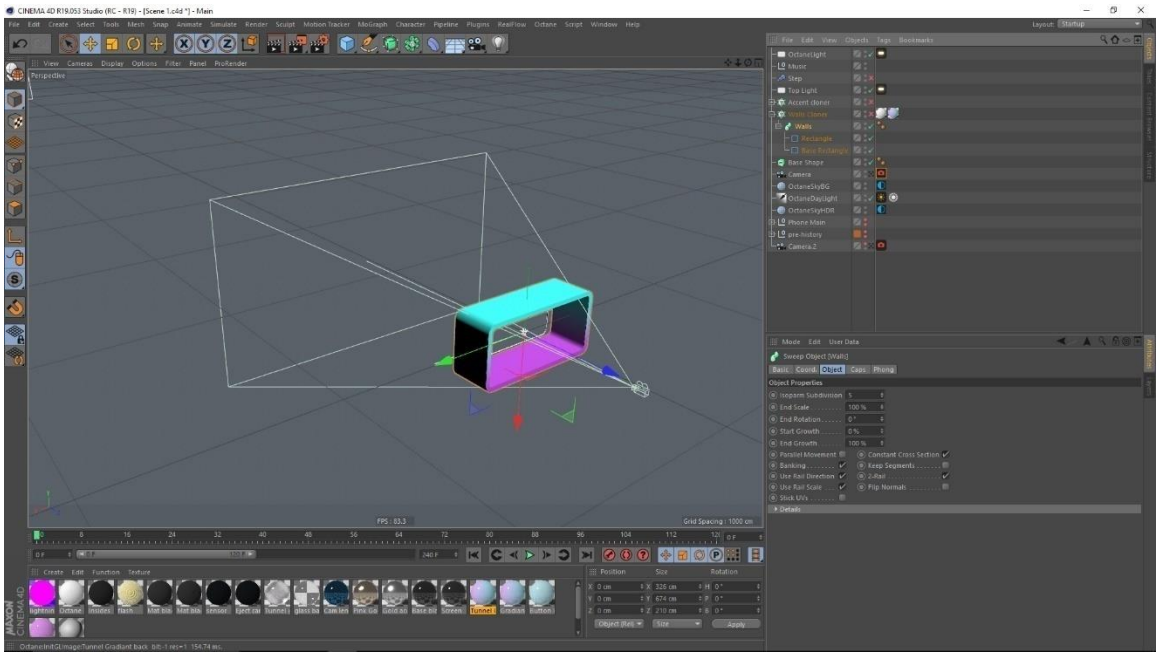

Figure 5.2.1: Use of sweep subdivision surface

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Used the array modifier of the mograph to create a lot of rectangle boxed in a row

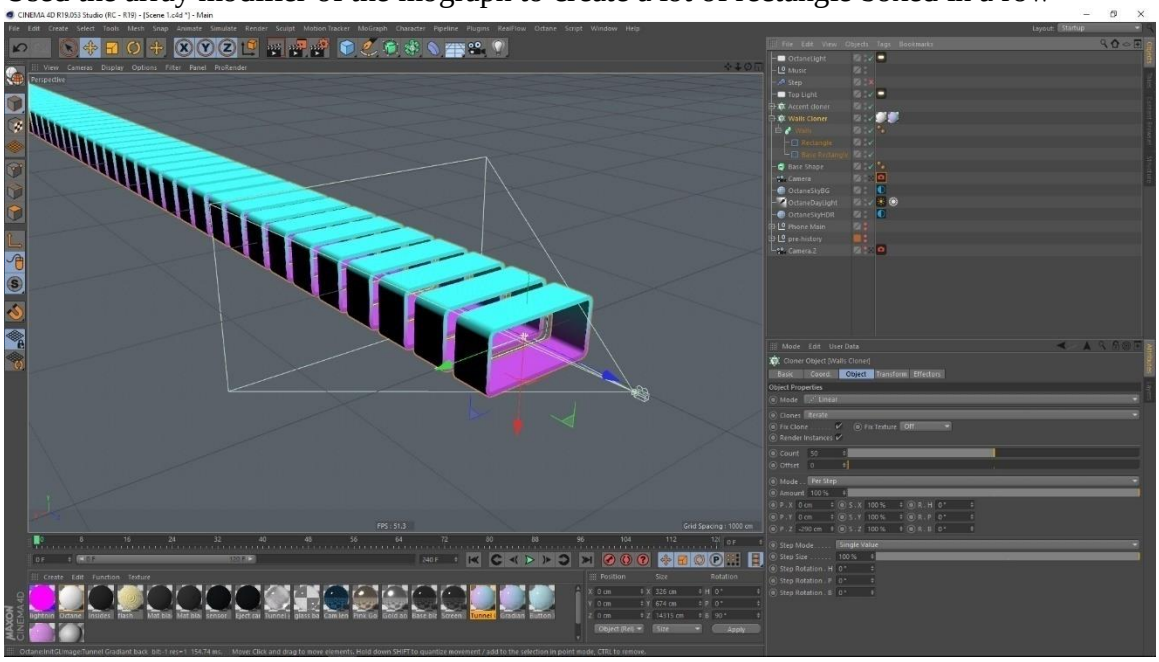

Figure 5.2.2: Use of Array Modifier

Used the step modifier of the mograph to create a twist in the line of rectangle tunnel

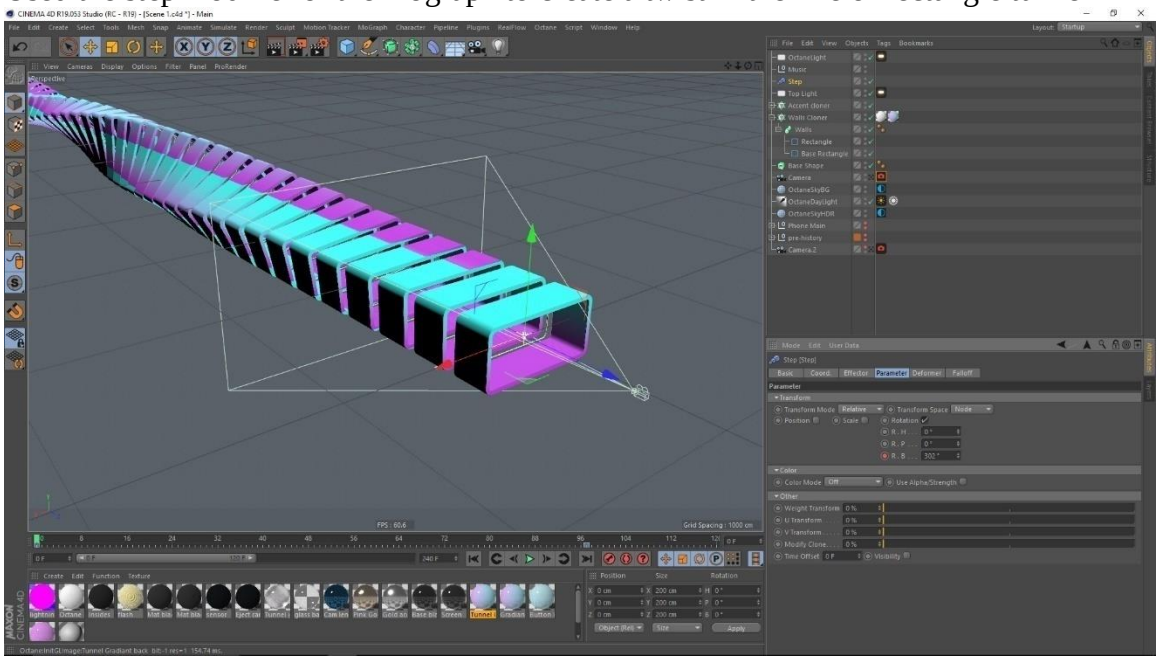

Figure 5.2.3: Use of Step Modifier

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Setting the final view from camera.

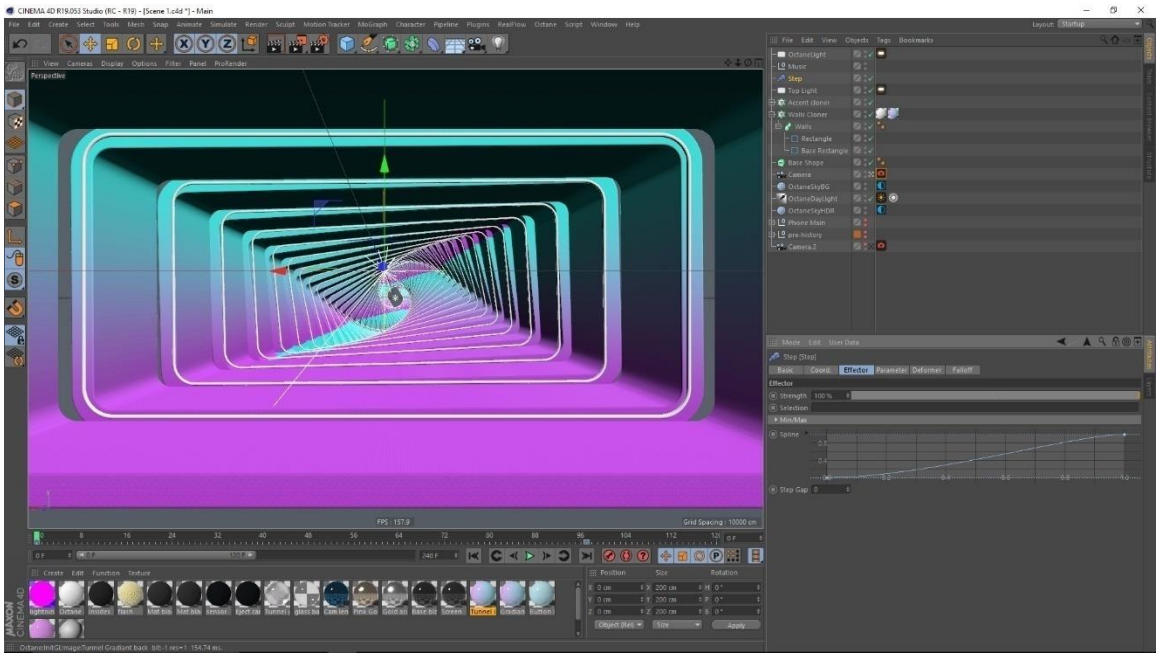

Figure 5.2.4: Inside view of scene

In this scene the tube is create to create that shock wave flow

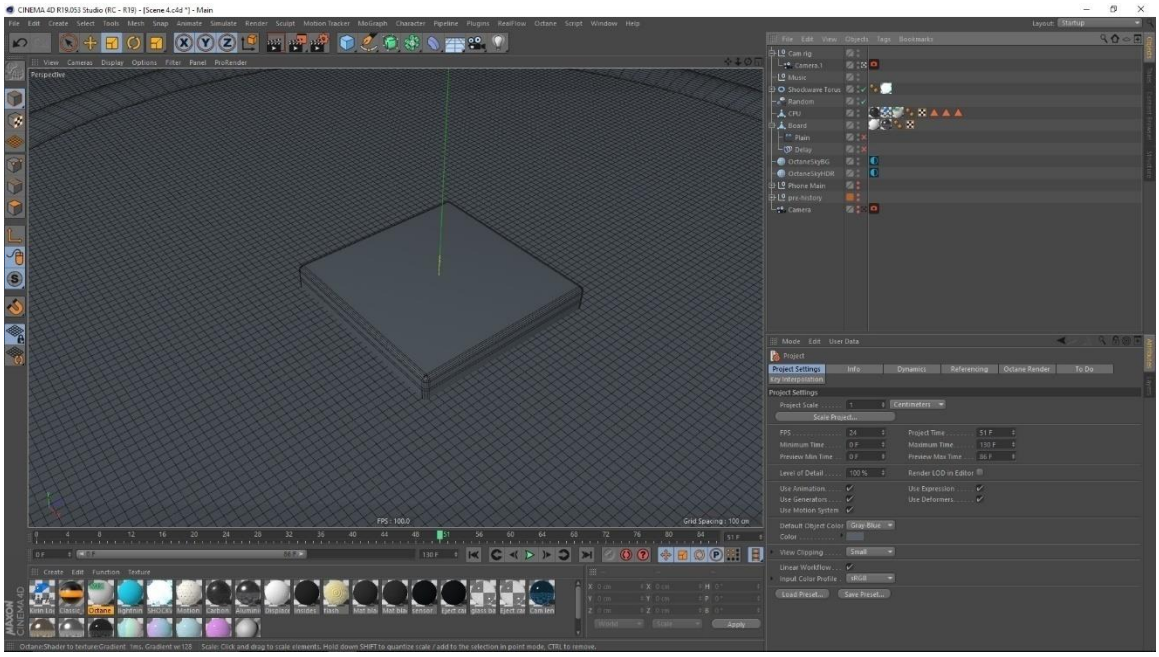

Figure 5.2.5: Creating of tube for shockwave

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In this scene used the plain effector to change the shape of the surface and get that ring type effect upward

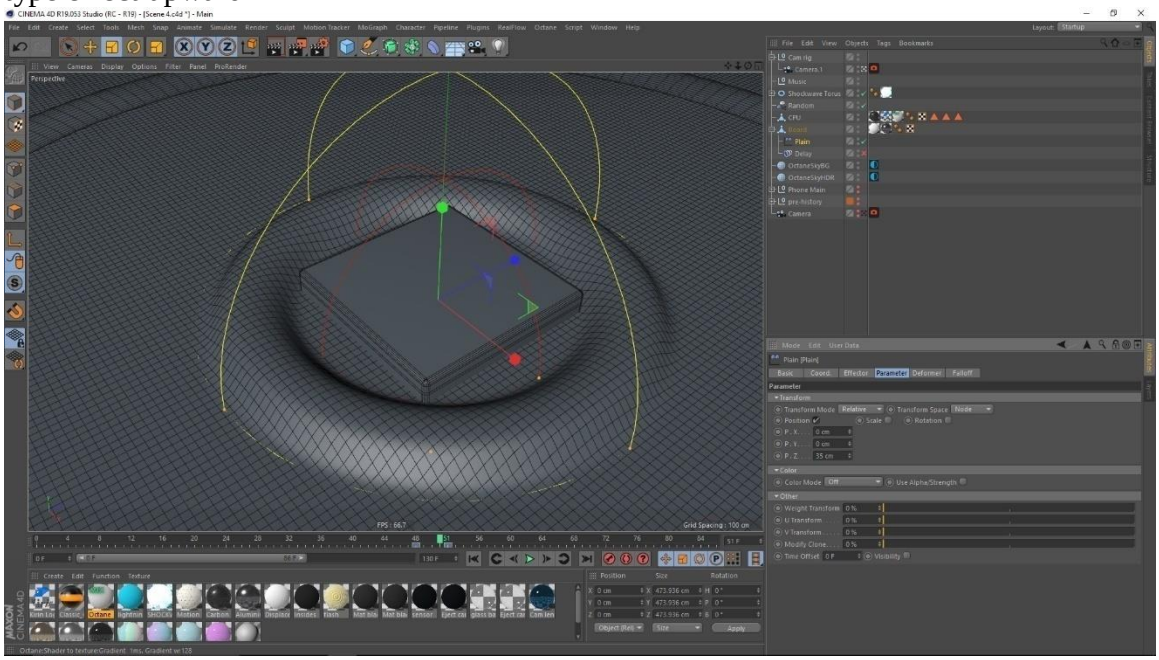

Figure 5.2.6: Use of Plain effector

Use of delay effector in mograph to get detail flow when the plain effort start working and looks pleasing to eyes.

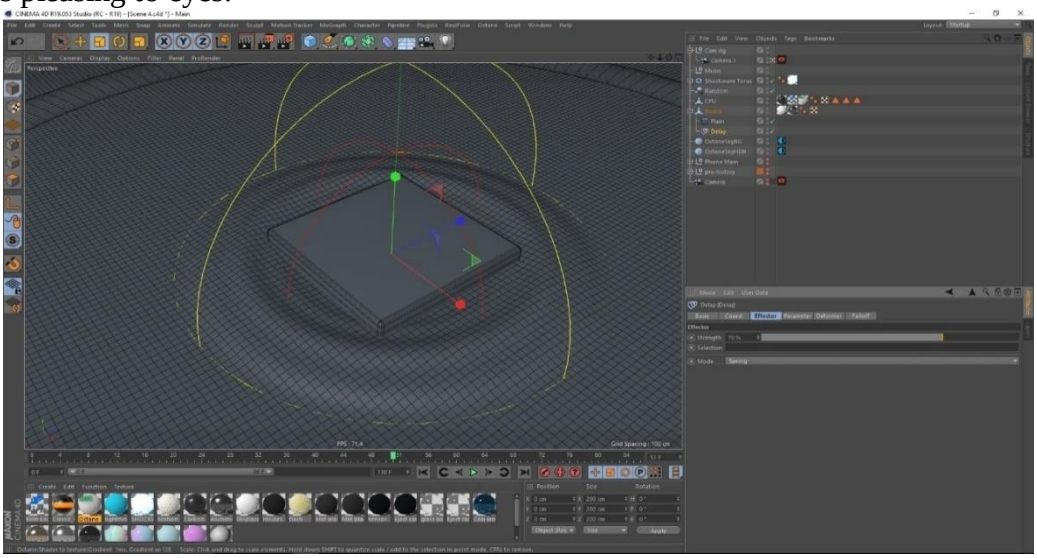

Figure 5.2.7: Use of Plain effector

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Testing the final fx with materials added.

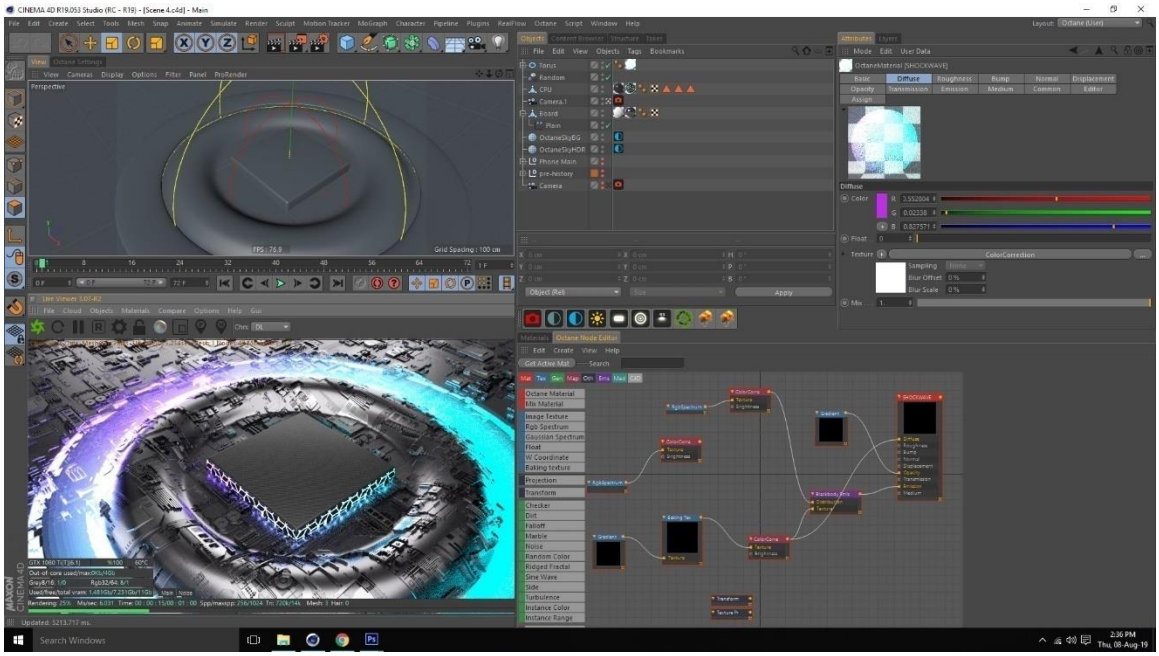

Figure 5.2.8: render of the fx effect created

Here the array to create cone for the details parts of the camera lens

Figure 5.2.9: Array effector for camera lens

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Test Rendering a frame under the hdri map to see the intensity and reflection on the object

Figure 5.2.10: Lens organized

Use of step effector to get the compress effect among the lens

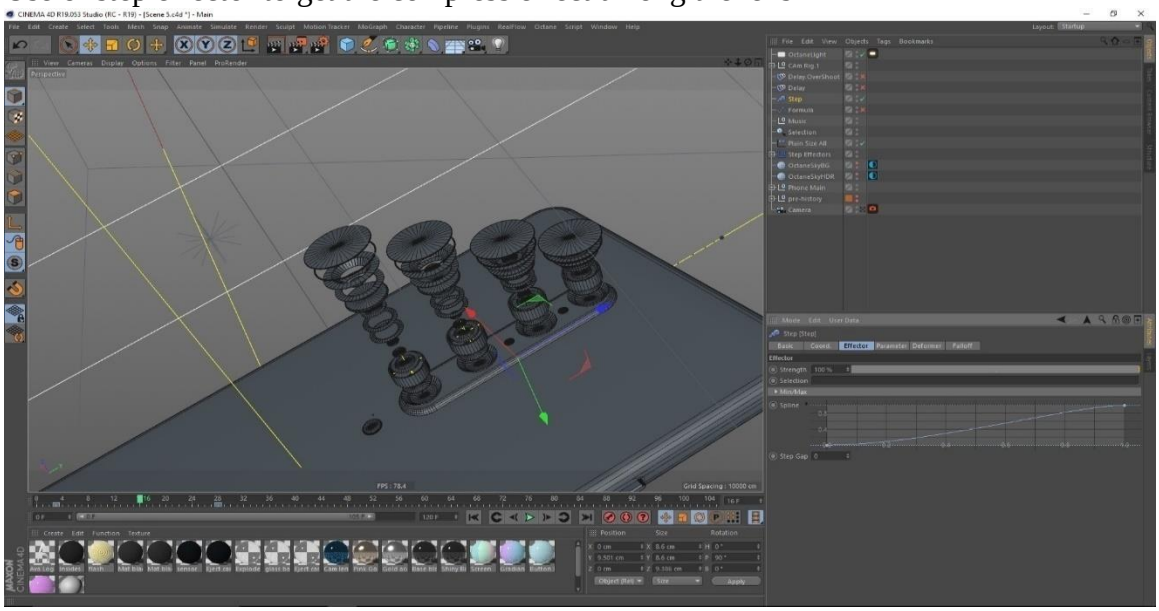

Figure 5.2.11: Plain Effector

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Formula effector in mograph is used to animate the first to last clone object

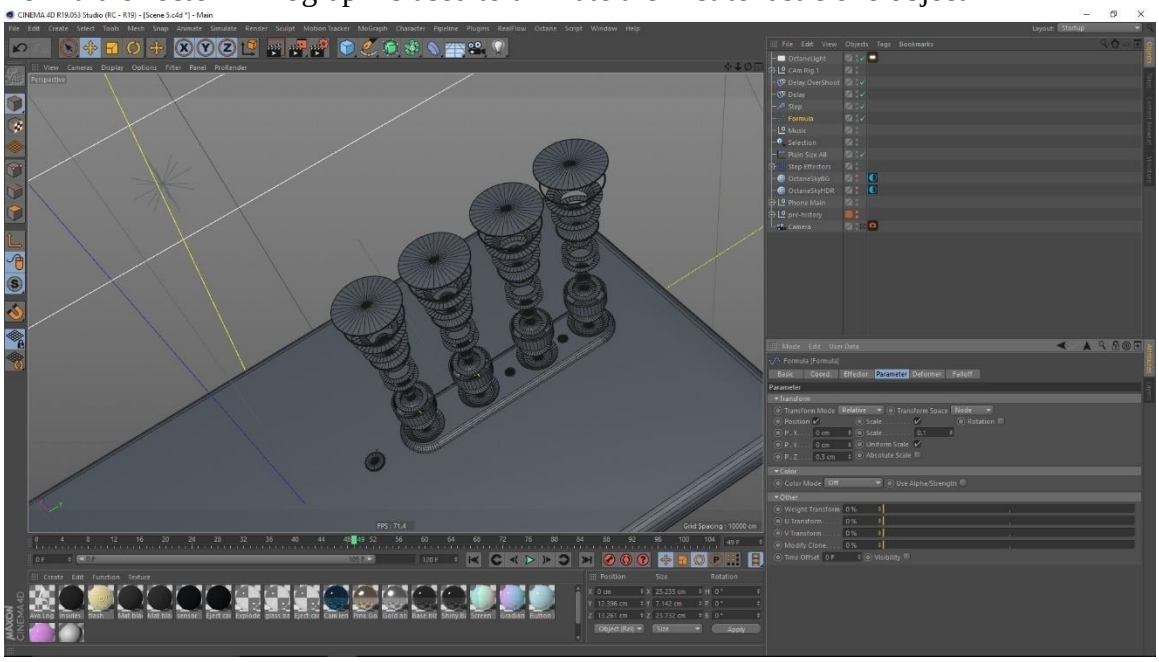

Figure 5.2.12: Use of Formula Effector

The phones were created with the help of array

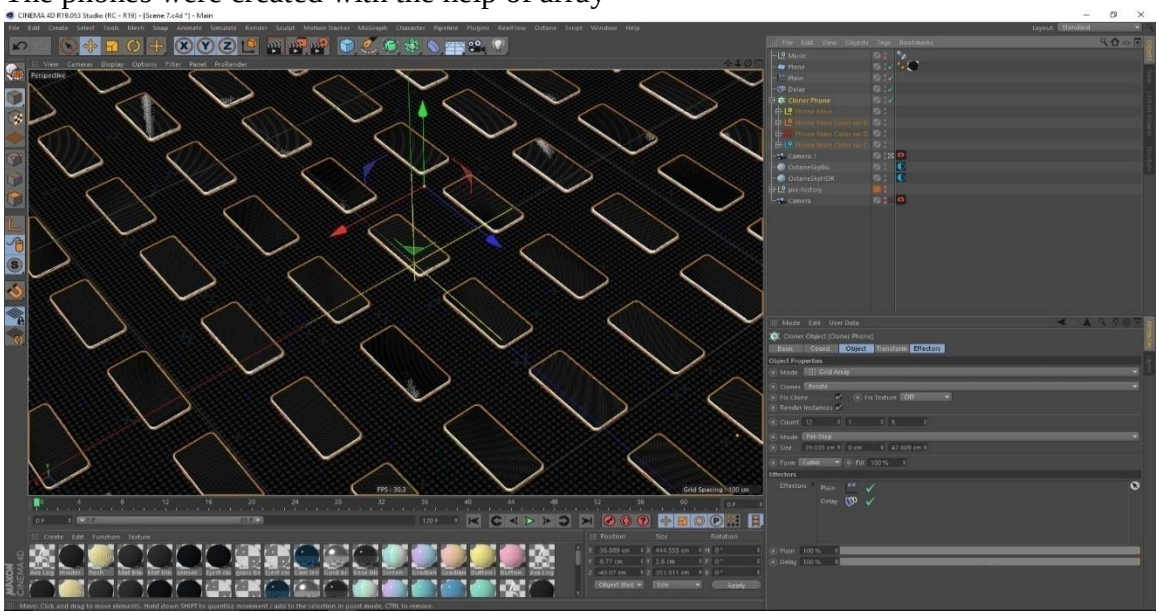

Figure 5.2.13: Use of array Effector

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Here the clone phones were given plain effector to get that flipping effect, by doing this the phone one the plan rotate in straight line.

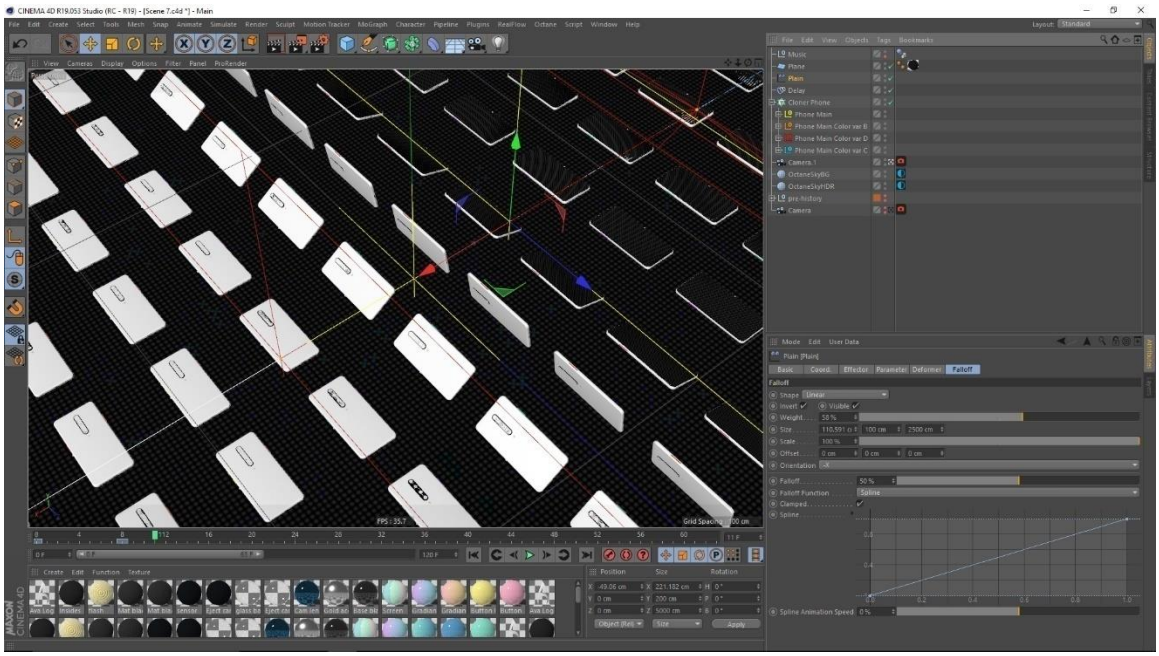

Figure 5.2.14: Use of Plain Effector

Placing the single elements.

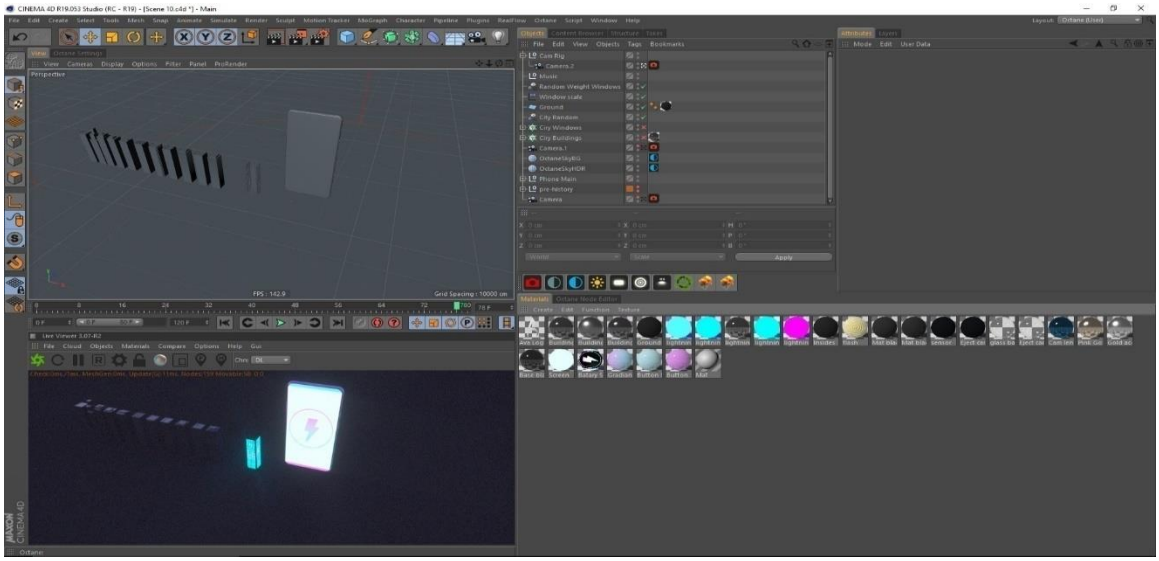

Figure 5.2.15: render view of scene

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All the buildings are being place with the help of array effector for making a big city

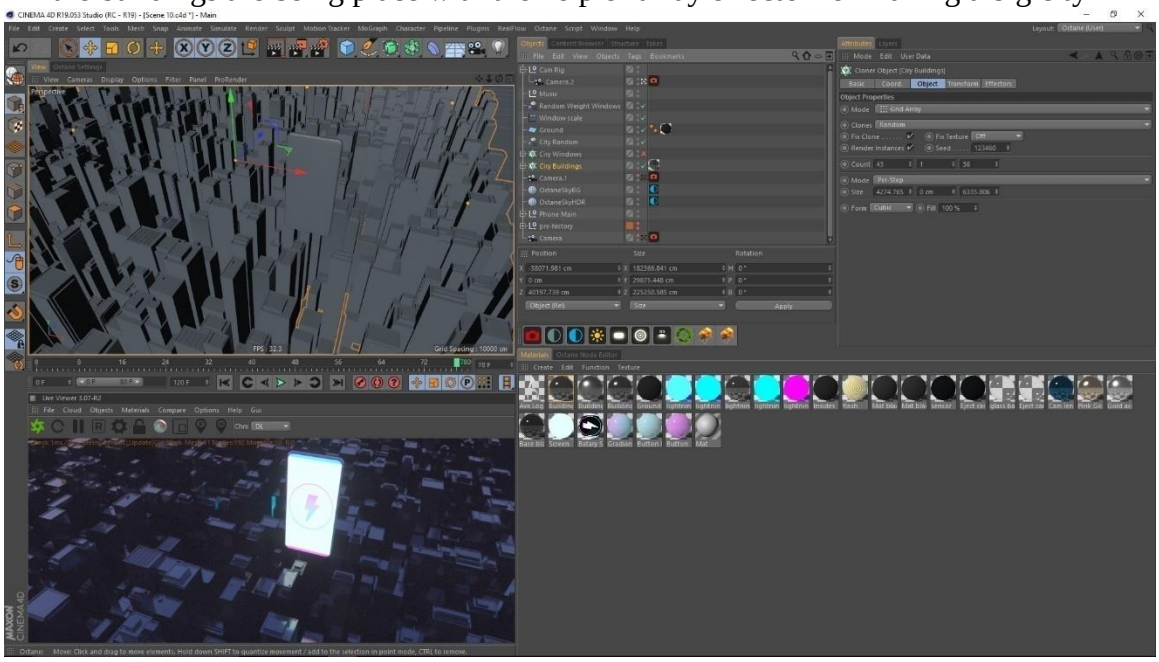

Figure 5.2.16: cloned by array effector

Uses of similar effector to give the windows of building and same peer is given to get the accurate position of the windows in exact number buildings.

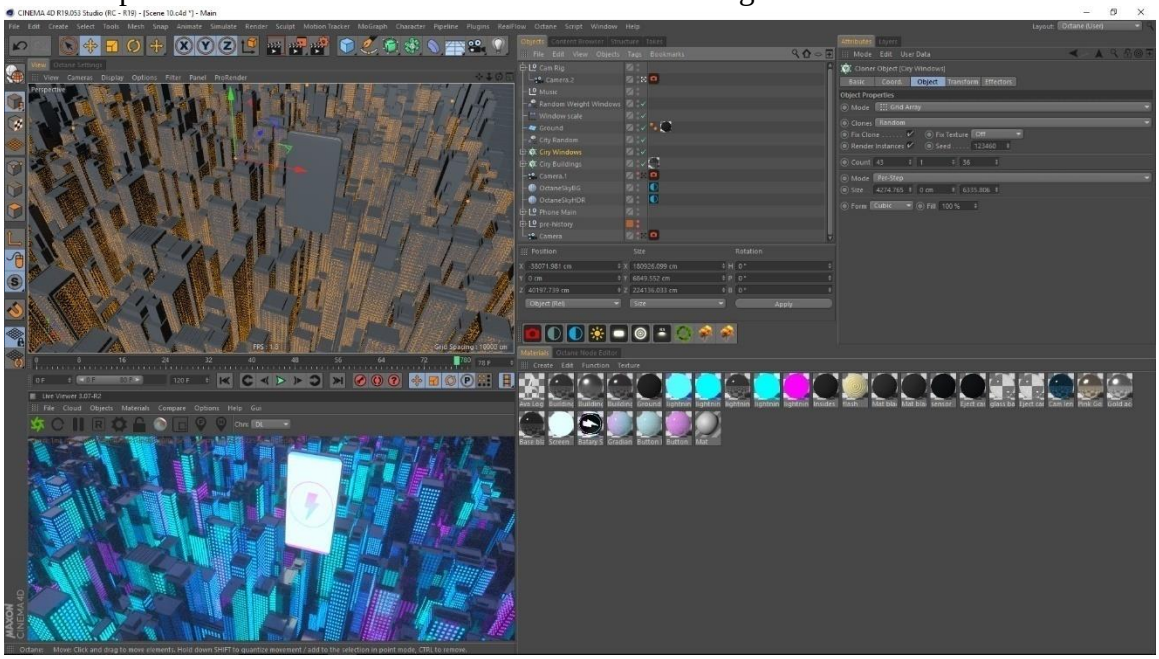

Figure 5.2.17: Use of Array Effector

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In this scene windows starting to pop in the building, this effect is created by the plain effector and scaling the position for the windows.

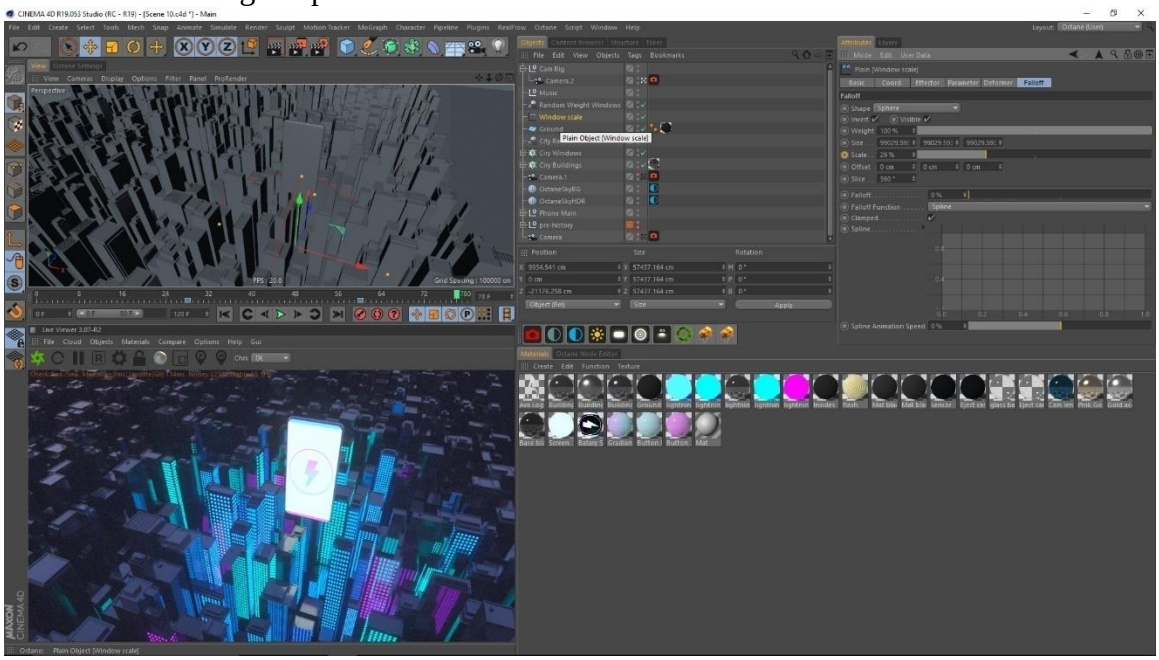

Figure 5.2.18: Use of Plain Effector

Starting with one model.

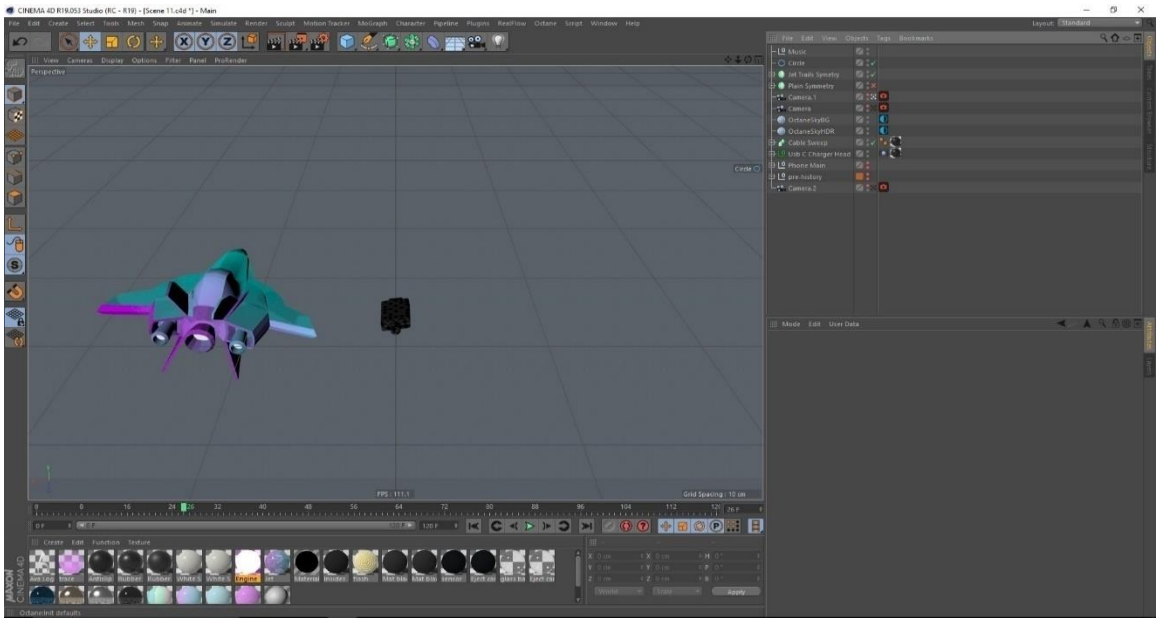

Figure 5.2.19: Models for the jet scene

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Jet is mirrored in this scene

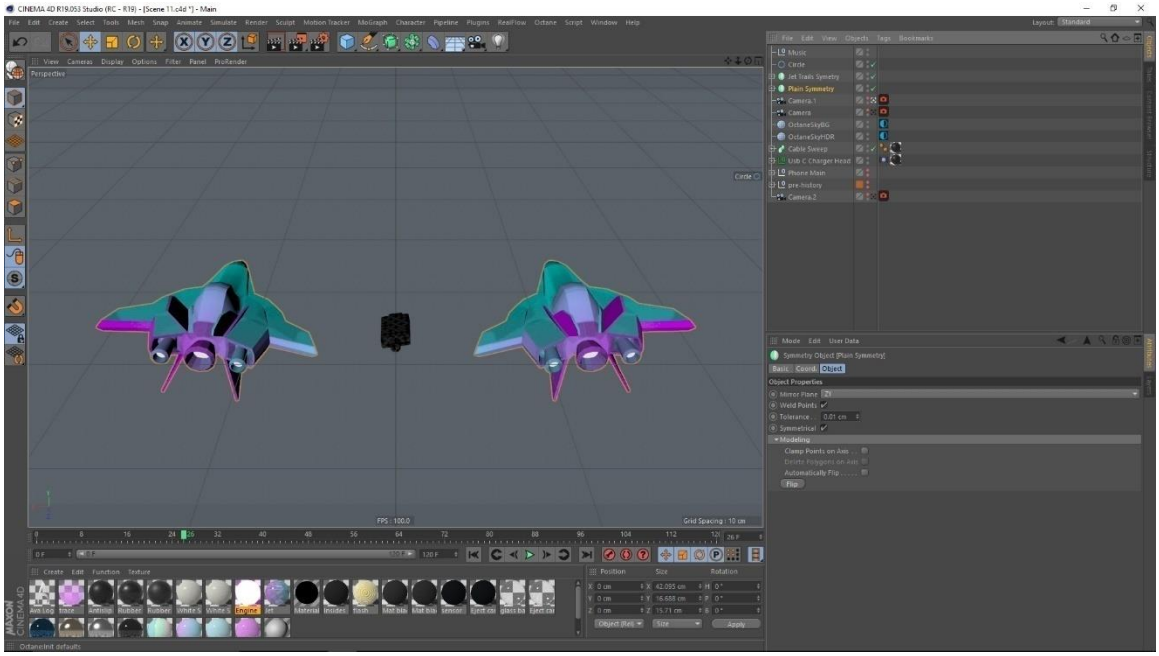

Figure 5.2.20: Jet mirrored

Jet Animation path is being trace here with a tracer plugin

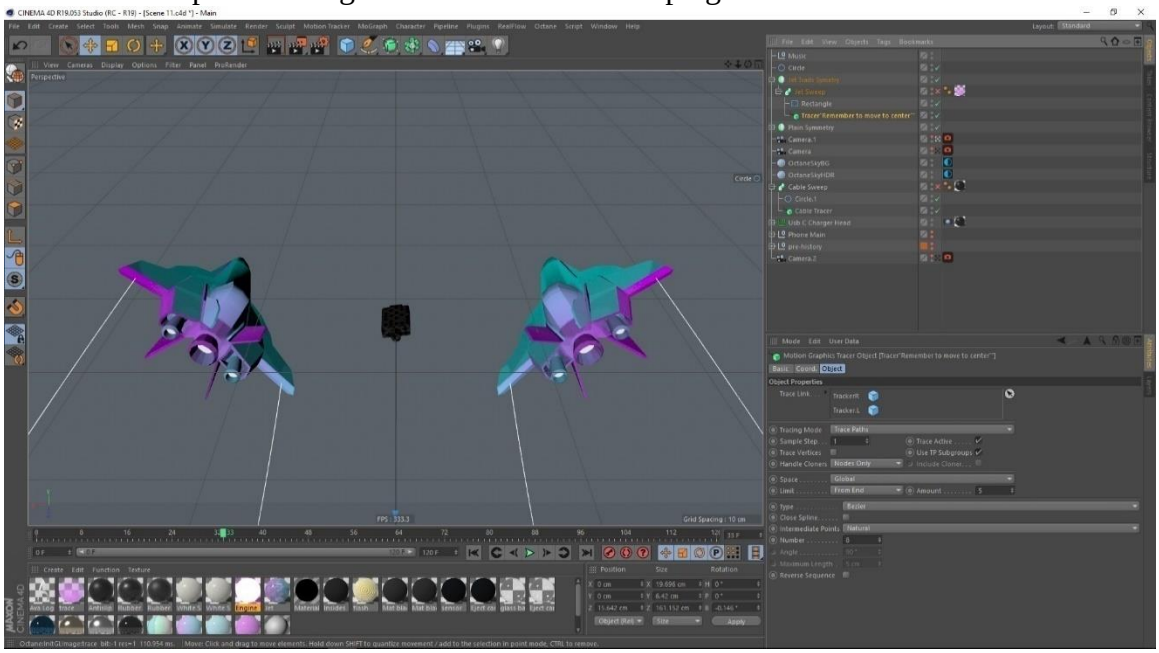

Figure 5.2.21: Jet path traced

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Traced path is then sweeped to get the polygonal shape

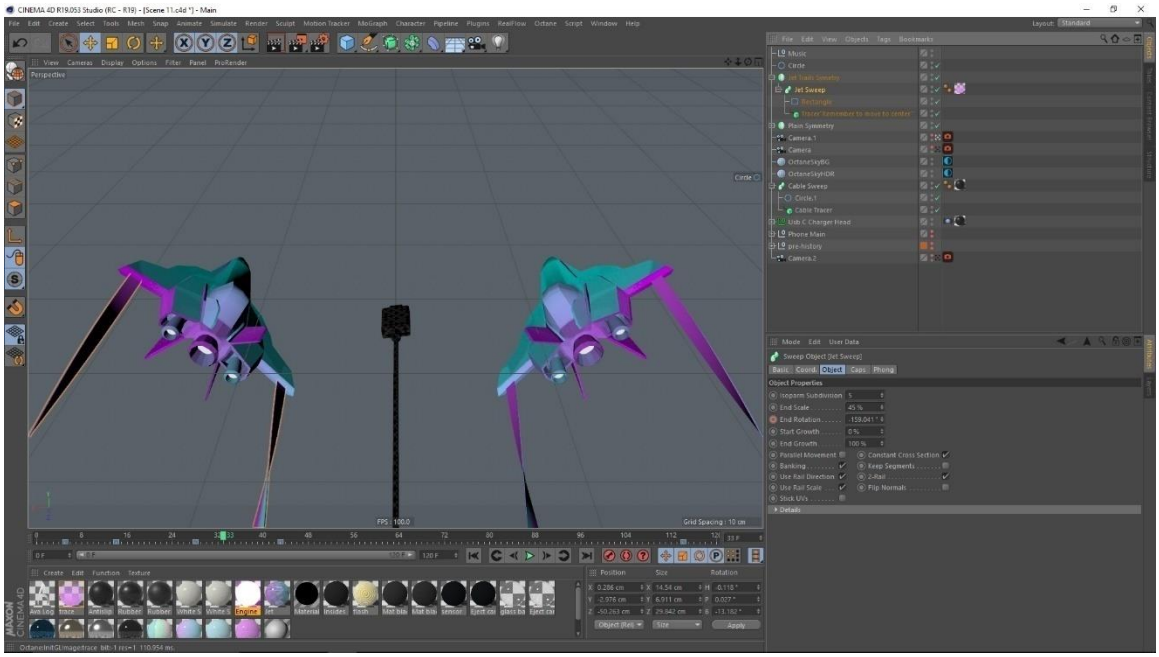

Figure 5.2.22: Jet path traced

Use of the turbulence fd plug in for the smoke simulation effect

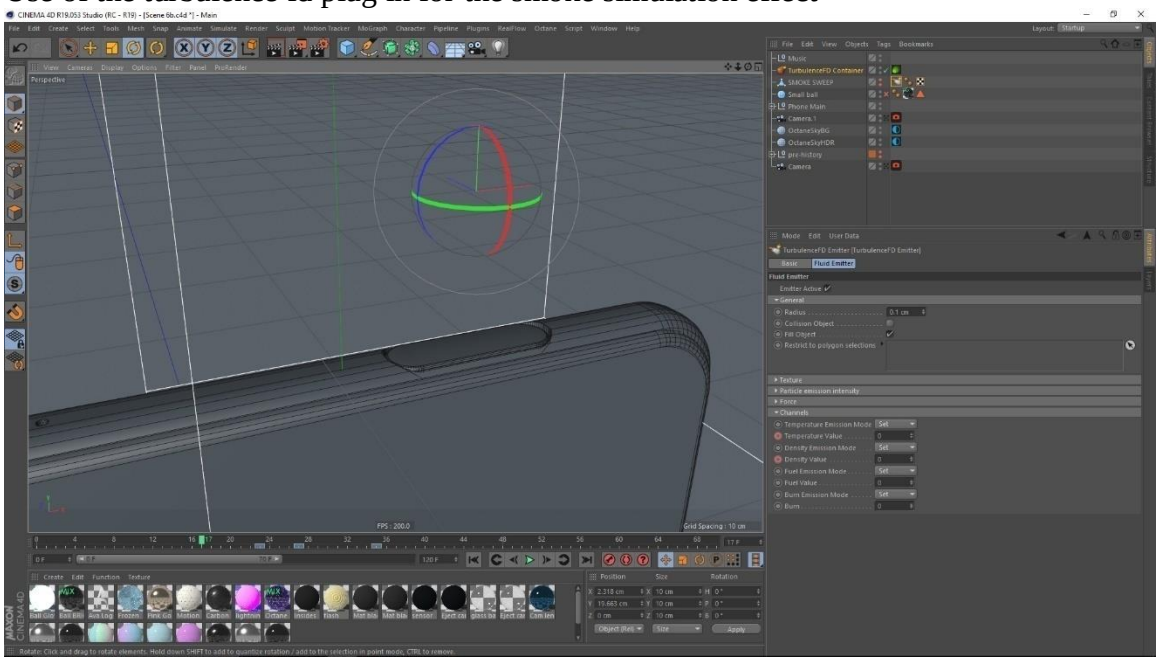

Figure 5.2.23: Turbulancefd for simulation

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Simulation from a rectangle place with the camera and animated the turbulencefd parameter for the smoke simulation

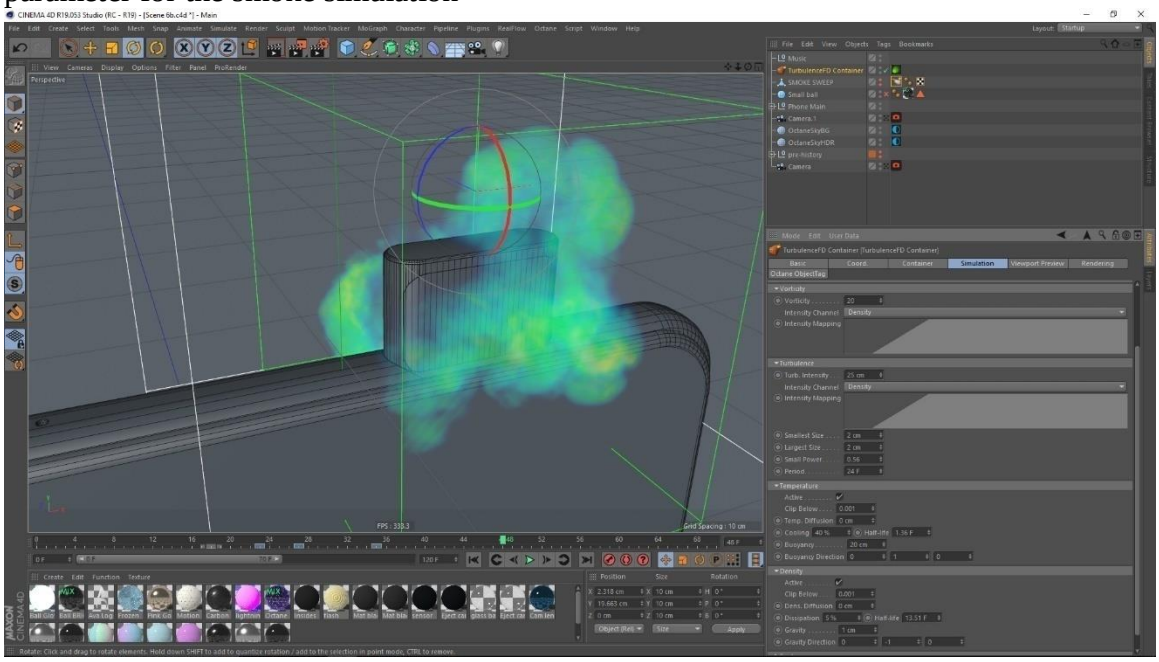

Figure 5.2.24: Smoke simulation

Setting the scattering and absorption medium for smoke render.

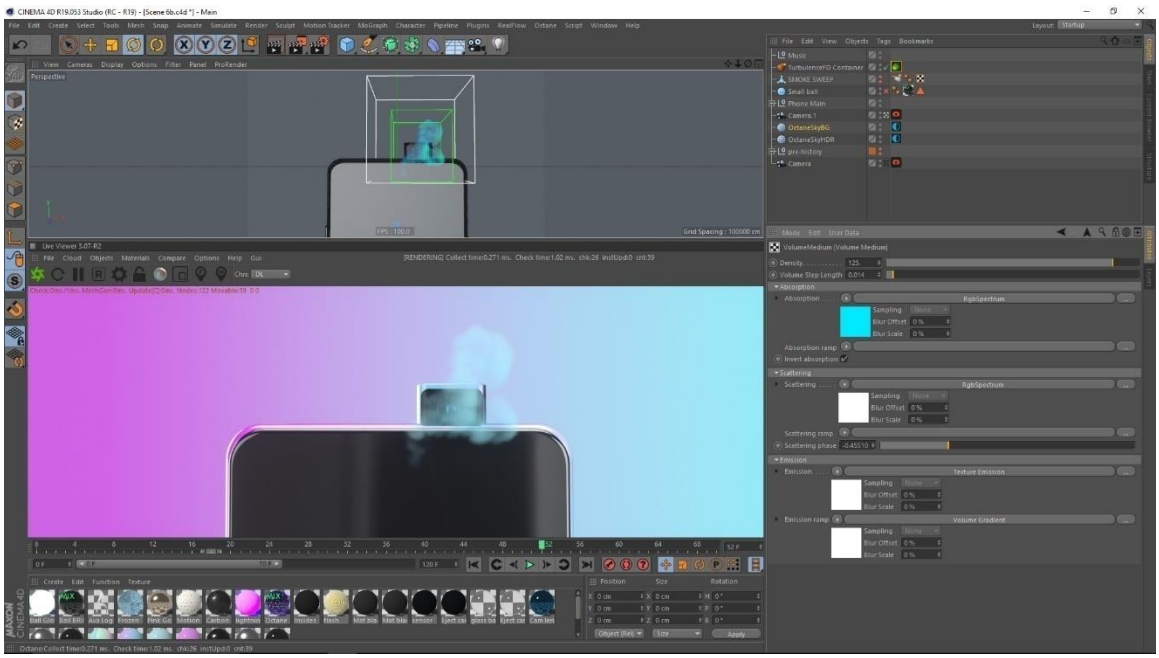

Figure 5.2.25: Render view of smoke simulation

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CHAPTER – 6

Rendering

6.1 Introduction:

I used Octane renderer as the main render engine to render frames using GPU rendering. Which created relative fast results with good-looking outputs. The rendering was done in 1920 by 1080 resolution and rendered at 24 fps.

6.2 Rendering procedure:

All the setting for the render are being set here. Its done from octane renders Octane Settings tab. The samples and other parameters are being adjusted to fit the scene.

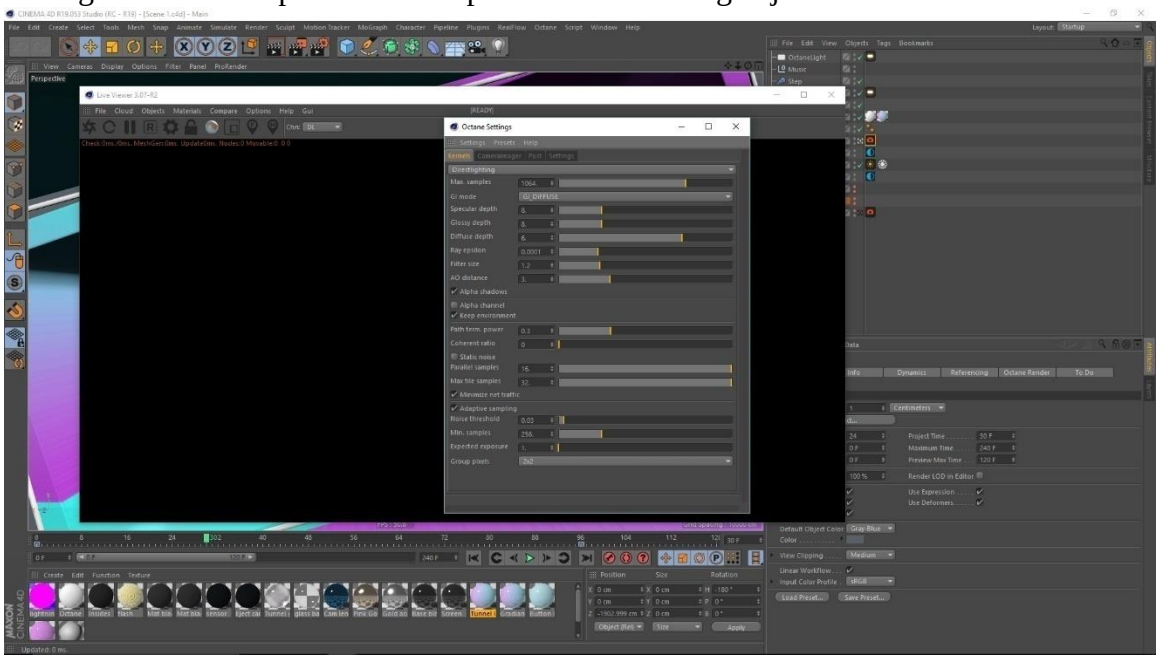

Figure 6.2.1: Render setting

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A few more render settings for some scenes.

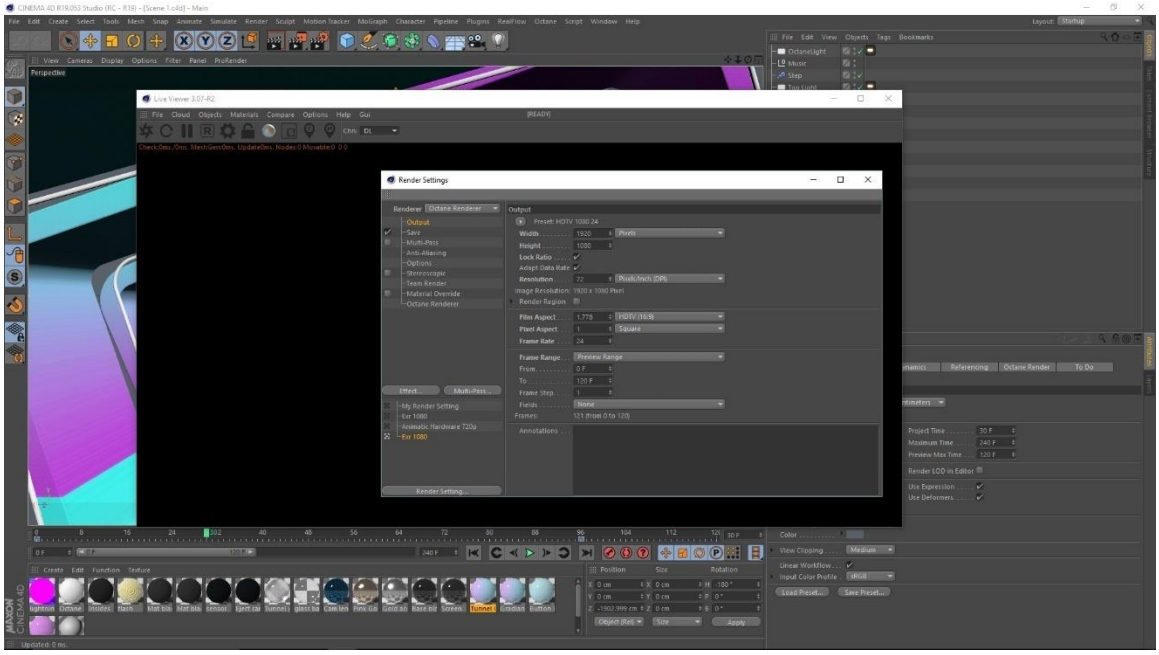

Figure 6.2.2: Octane Render setting

Setting the destination file path and format. Here I select the Open EXR format for rendering.

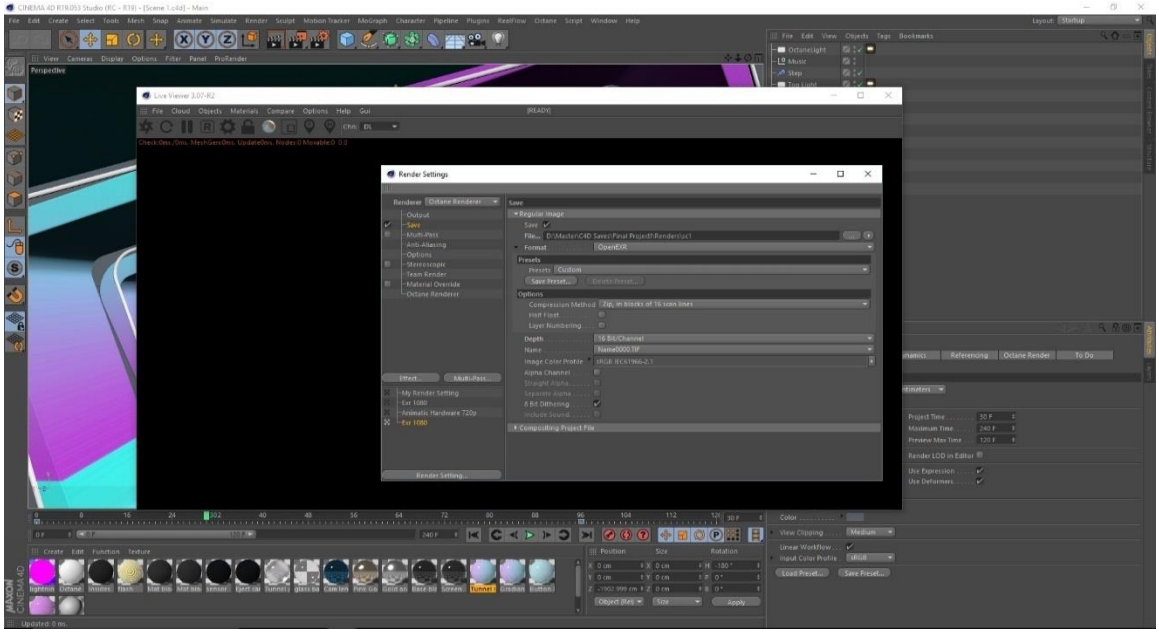

Figure 6.2.3: Octane Render setting

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Testing the output in the live viewer.

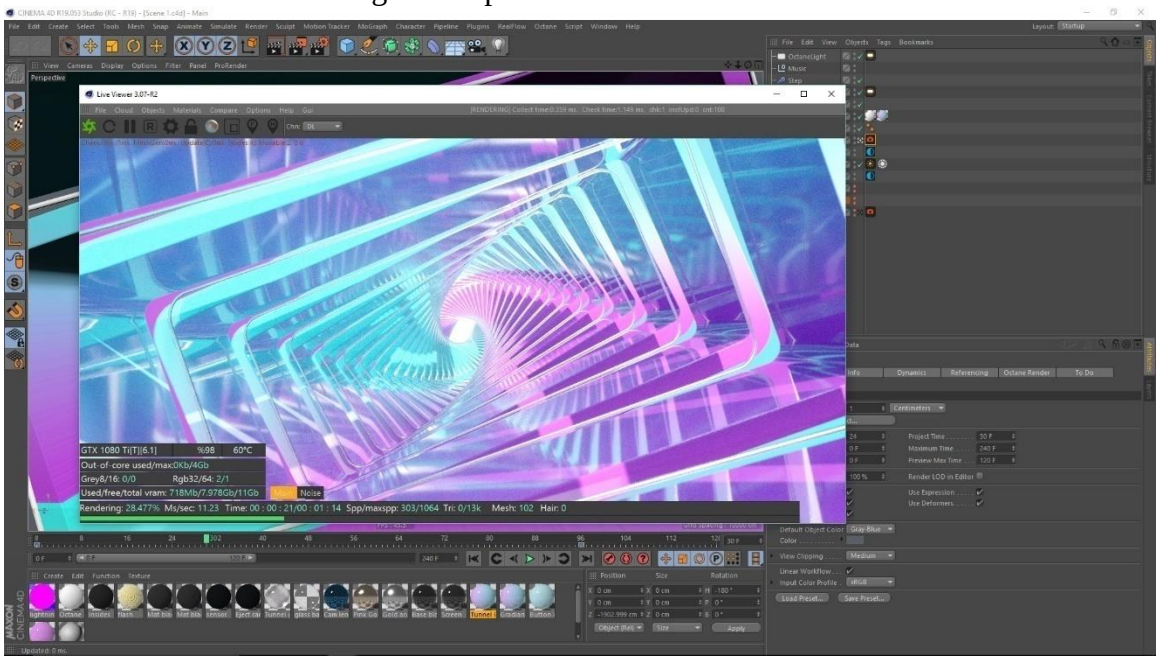

Figure 6.2.4: Render image

Viewing the render output and noise level.

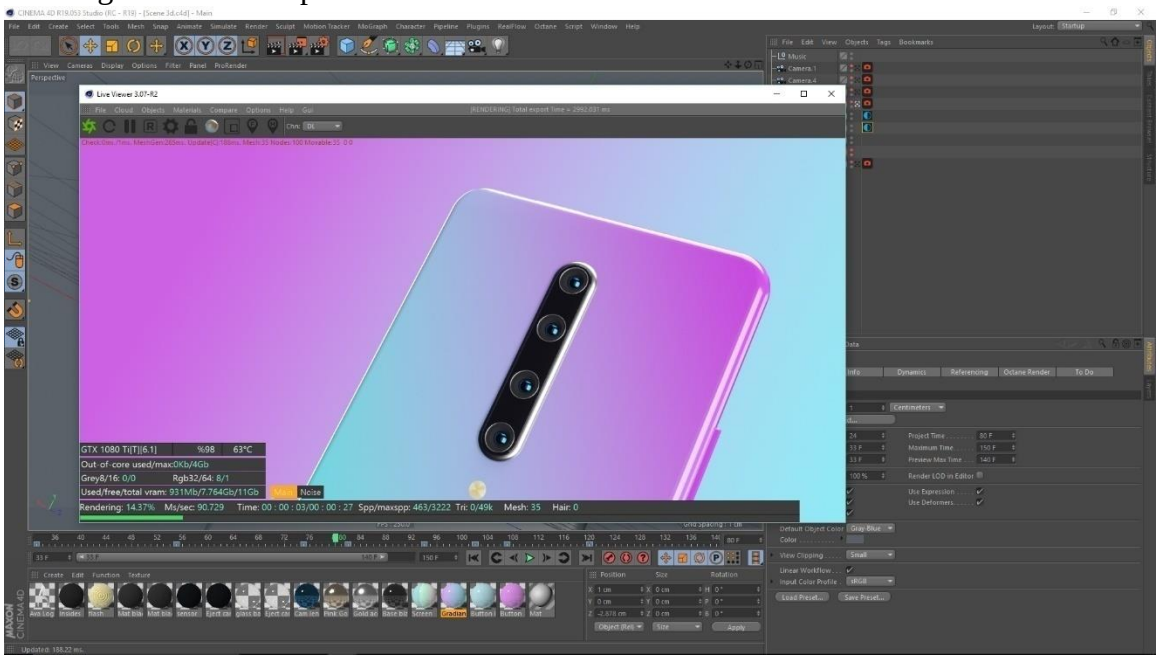

Figure 6.2.5: Render image

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Seeing the final output of some scenes.

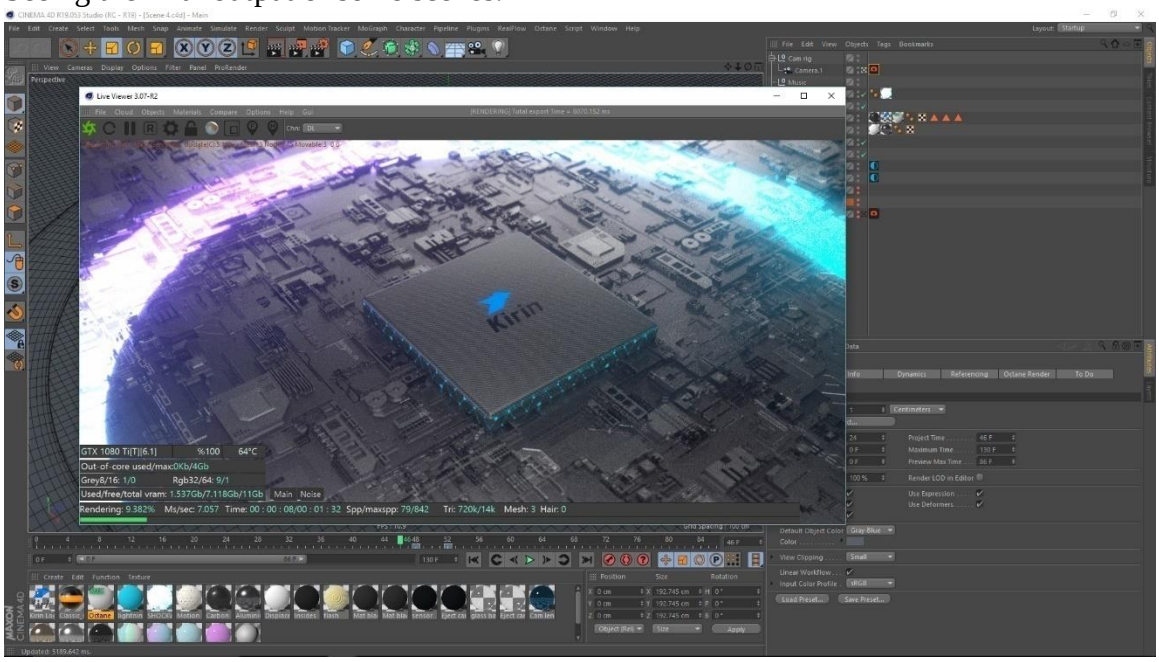

Figure 6.2.6: Render image

Testing the render time for a single frame with varying noise levels.

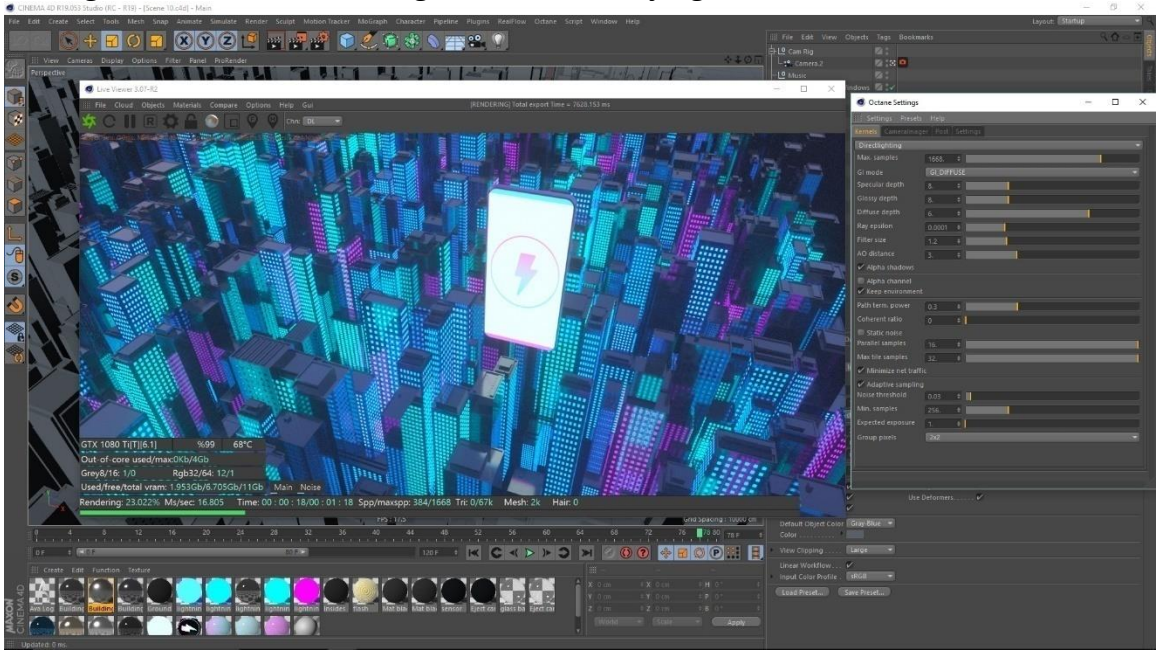

Figure 6.2.7: Render image

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Rendering to the picture viewer.

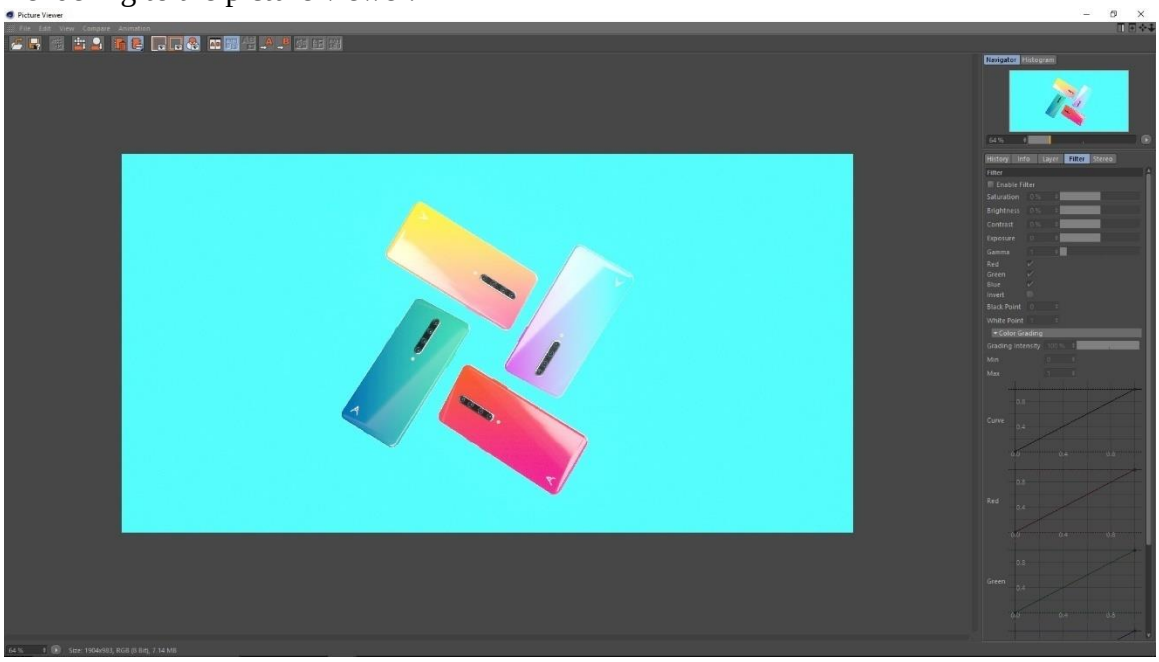

Figure 6.2.8: Render image

Rendering out image sequences and saving them in a folder.

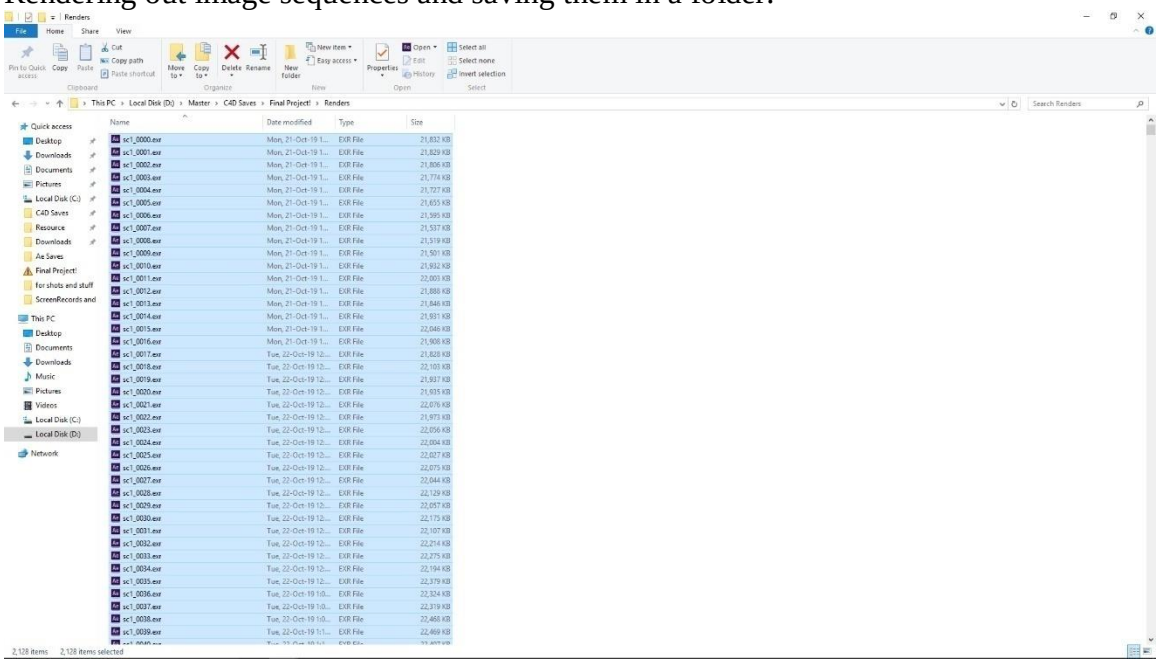

Figure 6.2.9: Render Image in folder

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CHAPTER – 7

Conclusion

The ever-changing mobile landscape gives brands lots of room to be creative in how they market to consumers in the space. Now, rather than seeking engagement through banner ads or videos on mobile, advertising technology company has leveraged 3D adverts to help brands target and engage with their audience. 3d advert deliver a realistic virtual showroom experience on mobile, which is more compelling and immersive than traditional 2D ads.

This project will be challenging for me. Making a quality standard advert maintain color, concept building and catching the eye of viewers at the whole advert will be difficult. In our country 3d advert is not that much flourished because of budget issue. Local brands are not interest in investing 3d advert as it is costly but there are unaware of the fact that it is the most standard and abstract form to create consumers, also will give them much more return. With CGI, you can highlight your product's best features. With CGI, we can show our product from all angles, in different colors, and in all variations.

The concept of 3D mobile ads is certainly innovative in our country, but creating a quality 3D ad is no easy task. The high quality has to be delivered by showing mobiles attractive features frame by frame is quite a hard work. With 3D ads, shoppers are able to experience your products and explore them in more detail than through any static image.

Our target is provide a quality full CGI 3d Mobile advert which will be standard like those of Samsung, apple and others. As the technology is Bangladesh changing we should welcome 3d in advertising sector rather than only traditional live action.

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