

FINAL YEAR THESIS

**Modeling, UV Unwrapping, Texturing, Rigging and
Animation of
“Through the Window”: A 3D Animation Short Film**

BY

Towhiduzzaman Shehan

ID: 161-40-323

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

Supervised By

Mr. Arif Ahmed

Associate Professor

Department of MCT

Daffodil International University



DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

DECEMBER 2019

APPROVAL

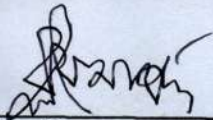
This Project titled “**Through the Window**”, submitted by Towhiduzzaman Shehan, to the Department of Multimedia and Creative Technology, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Multimedia and Creative Technology and approved as to its style and contents. The presentation has been held on 26th December, 2019.

BOARD OF EXAMINERS



Dr. Shaikh Muhammad Allayear
Associate Professor and Head
Department of MCT
Faculty of Science & Information Technology
Daffodil International University

Chairman



Mr. Arif Ahmed
Associate Professor
Department of MCT
Faculty of Science & Information Technology
Daffodil International University

Internal Examiner



Md. Samaun Hasan
Lecturer
Department of MCT
Faculty of Science & Information Technology
Daffodil International University

Internal Examiner



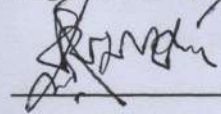
Dr. Mohammad Zahidur Rahman
Professor
Department of CSE
Jahangirnagar University

External Examiner

DECLARATION

We hereby declare that this project has been done by us under the supervision of **Arif Ahmed**, Associate Professor, Department of MCT, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:



Arif Ahmed
Associate Professor
Department of MCT
Daffodil International University

Submitted by:



Towhiduzzaman Shehan
ID: 161-40-323
Department of MCT
Daffodil International University

ACKNOWLEDGEMENT

First, we express our heartiest thanks and gratitude to Almighty God for His divine blessing makes us possible to complete the final year project successfully.

We are really grateful and wish our profound indebtedness to **Mr. Arif Ahmed, Associate Professor**, Department of MCT Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of “**3D Modeling and Animation**” helped us to carry out this project. His endless patience ,scholarly guidance ,continual encouragement , constant and energetic supervision, constructive criticism , valuable advice ,reading many inferior drafts and correcting them at all stages have made it possible to complete this project.

We would like to express our heartiest gratitude to **Dr. Shaikh Muhammad Allayear, Associate Professor and Head**, Department of MCT, for his kind help to finish our project and also to other faculty members and the staff of MCT department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discussion while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

The way people express their thoughts is changing day by day. 3D animation is one of the new variations of these mediums. As modern technology is in its peak position right now, 3D animation process is now competent enough to express any story with the looks, colors and emotions of any real-life object or character. While our interest was in 3D animation, we also wanted to convey a message through a story relatable to our culture and society around us. So, we chose a story around child labor, which is a complex social problem in our country. It was our goal to articulate the story in a dynamic yet deep and understandable way through the whole process from story building to modeling, sculpting, texturing, rigging, animation, light setup, rendering and post processing. The final output of this project is a video footage that combine all the work that is done hopefully expresses the idea behind making it. We hope, this project will redefine the idea of 3D animation in our country.

TABLE OF CONTENT

CONTENTS	PAGE NO
APPROVAL	i
DECLARATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
TABLE OF CONTENT	v
LIST OF FIGURES	viii
CHAPTER 1	1-13
Introduction	1
1.1 Backstory:	1
1.2 Motivation:	2
1.3 Objectives: Objectives of this project are:	2
1.4 Literature review:	3
CHAPTER 2	4-64
Methodology	4
2.1 Modeling:	4
2.1.1 Bag:	4
2.1.2 Generator:	6
2.1.3 Stand Fan:	9
2.1.4 Carton box:	9
2.1.5 Hanging Bulb:	10
2.1.10 Character Modelling:	16
2.2 UV Unwrap:	21
2.2.1 Generator	21
2.2.2 Stand Fan:	22

2.2.3 Bulb and Bulb shader:	23
2.2.4 Trunk: Unwrap :	24
2.2.5 Traveller tree:	25
2.2.6 Glove:	26
2.2.7 Carton box :	27
2.3 Texturing	28
2.3.1 Bag/:	28
2.3.2 Generator:	30
2.3.3 Character Texturing:	32
2.3.4 Gamcha:	33
2.3.5 Slide:	34
2.3.6 Swing:	34
2.3.7.Cabinet:	35
2.3.8 Hanging bulb:	36
2.3.9 Traveller tree:	38
2.4 Mash:	41
2.5 Rigging:	43
2.5.1 Body Rigging:	46
2.6 Animation:	53
CHAPTER 3	574
Limitations and Challenges	55
3.1 Limitations:	55
3.2 Challenges:	56
CHAPTER 4	57
Some Problems and Solutions	57
CHAPTER 5	59
Conclusion	59

REFERENCES

60

LIST OF FIGURES

FIGURES	PAGE NO
Figure : 2.2 school bag	5
Figure: 2.3 school bag	6
Figure: 2.4 generator	7
Figure: 2.5 generator	8
Figure: 2.6 stand fan	9
Figure : 2.7 carton box	10
Figure: 2.8 hanging bulb	11
Figure: 2.9 bulb	12
Figure: 2.10 glove	13
Figure: 2.11 trunk	14
Figure: 2.12 traveller tree	15
Figure: 2.13 gamcha	16
Figure : 2.14 character modeling mili	17
Figure: 2.15 character modeling mili	17
Figure: 2.16 character modeling mili	18
Figure: 2.17 mili body.	19
Figure: 2.18 mili dress	19
Figure: 2.19 mili complete model	20
Figure 2.20 uv mapping	21
Figure 2.21 uv unwrapping generator	22
Figure 2.23 uv unwrapping stand fan	23
Figure: 2.24 uv unwrapping bulb and bulb shader	24
Figure : 2.25 uv unwrapping trunks	25
Figure 2.26 uv unwrapping traveller tree	26
Figure 2.27 uv unwrapping trunks	27
Figure: 2.28 uv unwrapping carton box	27
Figure 2.29 mili unwarping	28
Figure 2.30 school bag texturing	29
Figure: 2.31 school bag texturing	29

Figure 2.32 school bag texturing	30
Figure 2.33 generator texturing	31
Figure 2.34 generator render image.	31
Figure 2.35 mili skin texture	32
Figure 2.36 mili 's and her dress texture assigned.	33
Figure 2.37 gamcha texturing	33
Figure 2.38 slide texting on substance painter	34
Figure 2.39 swing texting on substance painter	35
Figure 2.40 cabinet texting on substance painter	36
Figure 2.41 hanging bulb texting on substance painter	37
Figure 2.42 seesaw texting on substance painter	37
Figure 2.43 traveller tree texting on substance painter	38
Figure 2.44 traveller tree test render imager	39
Figure 2.45 tree bark texting on substance painter	40
Figure 2.46 tree leaf map	41
Figure 2.47 leaf map	42
Figure 2.48 tree leaf map	42
Figure 2.50 character rigging step	44
Figure 2.51 character rigging symmetry	45
Figure 2.52 marge character	45
Figure 2.53 character binding method	46
Figure 2.54 character rigging	47
Figure 2.55 character rigging face	48
Figure: 2.56 character rigging face	49
Figure: 2.57 weight paint	49
Figure: 2.58 weight paint	50
Figure: 2.59 mirror weight paint	51
Figure: 2.60 hair weight paint	51
Figure: 2.61 character cloth weight paint	52
Figure: 2.61 preference	53
Figure: 2.62 pose to pose animation	54
Figure: 2.63 graph editor	54

CHAPTER 1

Introduction

1.1 Backstory:

Animation by definition is created by generating a chain of drawings or pictures taken by some sort of simulation procedure for creating movement. It creates an optical illusion through which we are able to see still images or drawings moving. 3D Animation is animating objects in a three-dimensional space, usually created via software which can be rotated and moved like real objects. A motion picture is considered one of the most common methods of presenting animation.

The story we developed titled “Through the Window” was decided to be made as a 3D animation because it was the most efficient way to convey our message. This project was heavily inspired by some animated short films by independent artists and studios like “In a Heartbeat”^[1] from Ringling college, “Piston”^[2] from ESMA Productions, “Coin Operated”^[3] Written & Directed by Nicholas Arioli and “Mr. Indifferent”^[4] from BadStache Animation Studio.

“Through the Window” is a one and a half minute long 3D animated short film which contains cartoon style characters in two different realistic environment or sequences. First sequence will be a school environment with adequate lighting and the second sequence will be a small congested old town cheap toy factory environment in dark lighting.

The story of the short film will portray the incidence of child labor in our society. In the first sequence a school boy plays with his new toy car on his way to school and on his way home from school he stumbles upon another boy of his age who was having a hard time making that very same toy car in a factory. This project will bring out the brutal reality of our socio-economic situation in front of people's eyes, about how regardless of age people have to work for minimum wages even when they are school-going age.

1.2 Motivation:

Now-a-days child labour has become normalized in our society. In this project both realities of the lives of privileged and underprivileged children will be shown side by side for comparison. This stark comparison will effectively communicate the circumstances that cost the basic right of education for an underprivileged child to the viewers.

In our society it is not uncommon to see children working instead of going to school just to feed themselves. Some employers make them work so much as though they were adults while they would never let their own children go through the same situations. It is the hypocrisy of the people with lower morals and no ethical standards. This regular but pathetic sight was the motivation behind developing such a story and make it into a 3D animation.

1.3 Objectives:

Objectives of this project are:

1. Create different props models
2. Create 3D characters with attractive, adorable features
3. Create two different environments to portray the story appropriately
4. Texture the models to make them look as close to real objects as possible
5. Rig and skin paint the characters to make them workable models for animation
6. Animate the characters with proper body language and facial expressions
7. Light the scenes properly for the maximum resemblance with real environment
8. Render the animated frames in proper quality and format
9. Color grade and assemble the scenes
10. Add sound effects to enhance the experience
11. Portray the social situation of child labor through 3d animation
12. Create awareness about child labor in a relatable way

Although the output of this project is a 3D animation but it is not necessarily targeted towards children. The target audience of this project are people of age thirteen and up but people of any age can watch the film and enjoy it.

1.4 Literature review:

Several 3D animations have been consulted to offer an in-depth analysis of the best methodology for the film. In the film "In a Heartbeat" Beth David and Esteban Bravo used a specific pattern for the environment in their film. Everything had a "Heart" shaped feel to them. The idea of selecting a pattern and stylizing all the props and environment according to that was inspiring. Some films use semi realistic environment style such as "Piston" of ESMA productions whereas others use super realistic background environment like that of Badstache studios "Mr. Indifferent". Luke Snedecor & Sarah Heinz at Chapman University created "Preheated"^[4] which portrayed a child character, which is a wonderful reference. The animated short film "Alike"^[5], directed by Daniel Martínez Lara & Rafa Cano Méndez, used a minimal but stylized background environment with the unique idea of rounded edged buildings. "Watermelon A Cautionary Tale"^[6] by Kefei Li & Connie Qin He had amazing animation and lighting but the background props were not much detailed and there were some noticeable mistakes where surfaces which were supposed to collide goes through each other instead. Problems like these inspired us to be looked into to eliminate in our film. 3D animated short film "The Present"^[7] was based on a great little comic strip by the very talented Fabio Coala. This film has excellent texture and lighting. Most of these films had a subtle depth of field as per needed in each scene which gives us a challenge to obtain. By studying all of these films and more we have chosen the best combination of designs, textures and environments to portray our story vividly and comprehensively.

CHAPTER 2

Methodology

2.1 Modeling:

There are a few types of modelling which includes Polygonal and Nurbs modelling. But for this project we chose polygonal modelling because it is more popular and more familiar to us. In this modelling process standard primitives like boxes, spheres and cylinders are used and modified to make various models. For modification, tools like extrude, bridge, combine and deformers like bend, lattice etc are used. While modelling all the props and characters it is strictly followed that all the polygons should be in quads. Because The description of the models I made are given below.

2.1.1 Bag:

The bag was made for our character Shanto and Mili. First, we found a reference of a bag which was go to our character.

1st part, I took a box which was subdivided with 5/5. Then the vertices were selected and for making the body shape of bag. The front faces were negative inset and extruded.

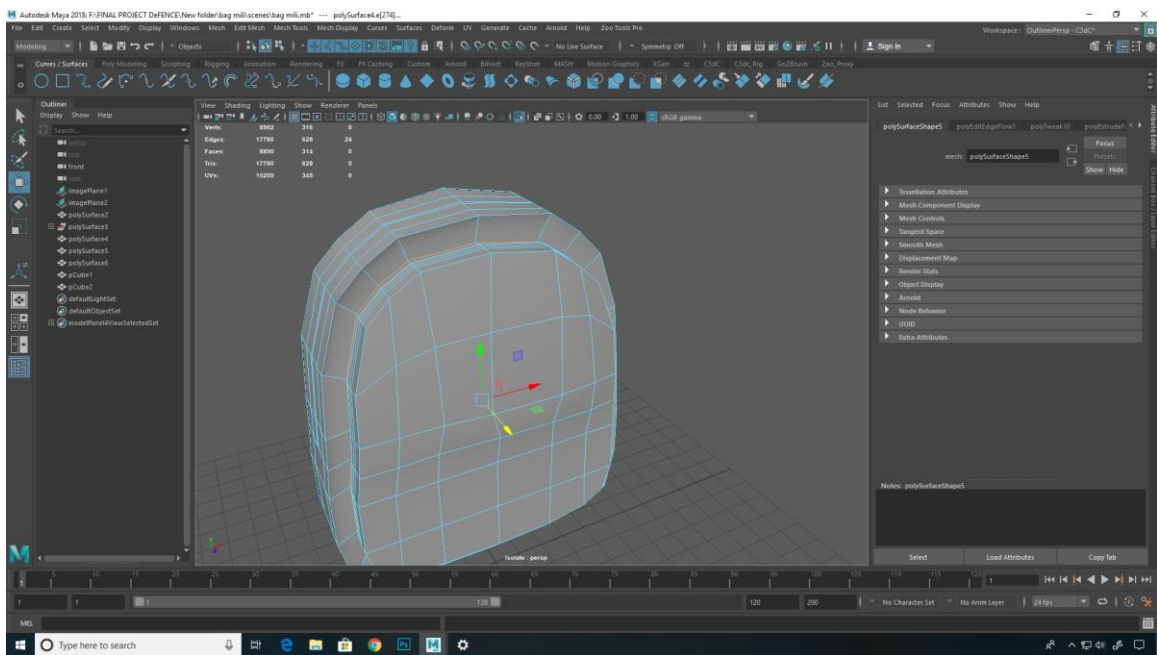


Figure: 2.1 School bag

Then I used Insert edge Loop tool for create a loop and drag that edge for the making of the body shape of this bag.

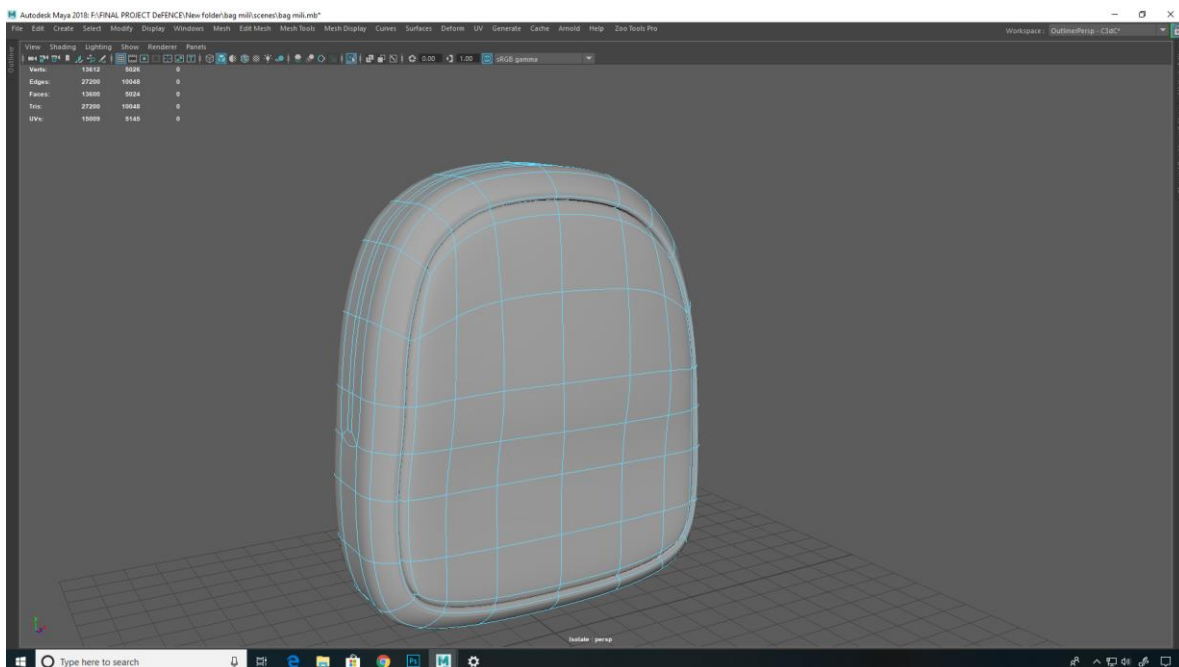


Figure : 2.2 School bag

2nd part, For the making of the pockets of the bag faces was duplicated where the pocket would be existed. Then dragging the vertices to brought the shape of pocket.

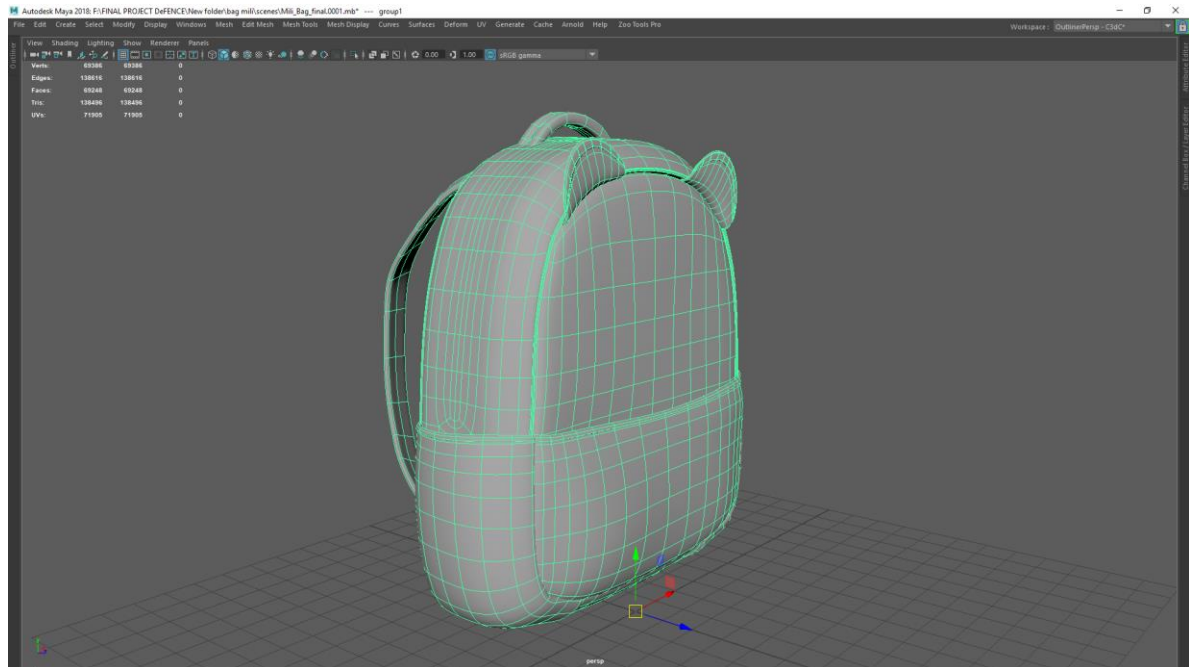


Figure: 2.3 School bag

The strap of the bag is made face of a box by extruding edge and placing them by dragging the vertices. The extrude the All faces for thickness. Added supported loops where it necessary. Then I subdivided the bag. The edge flow was maintained while making the model.

2.1.2 Generator:

Generator was made for our factory environment. First, I collect a reference of a generator. Then import as a reference image to make a model of generator. The generator has 3 main body parts which was made by PollyBox. Exhaust pipe, Buttons, wheel and Hendel made by Polly cylinder.

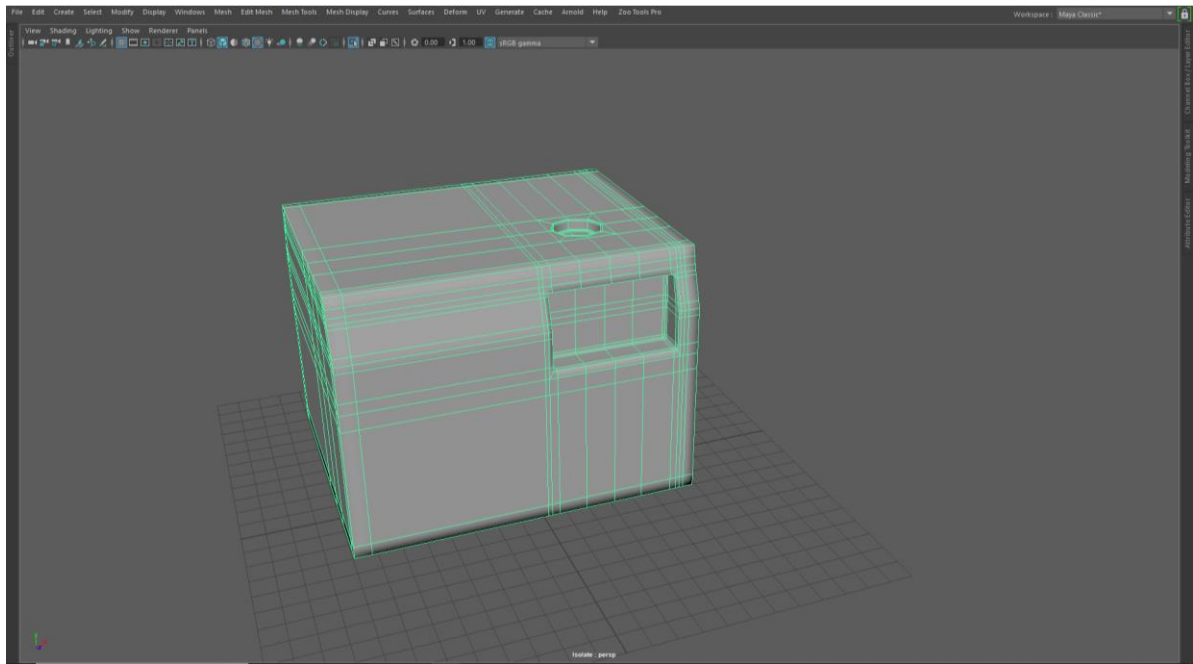


Figure: 2.4 Generator

At first, I use Poly Box for making the main body part of the generator. Then add supporting edge loops to get the edge smoother and get into the perfect shape. Then add a loop to the bottom of the front and slide forward to get a curve on the generator body. Then add supporting loops. For the controlling board of the generator the added loops for it and extrude it down and scale it to the “x” axis for a rectangular shape. For the fuel tank mouth was made by a cylinder with 8 subdivision Boolean with Generator body. Then add supporting loops by using multi-

cut

Tools.

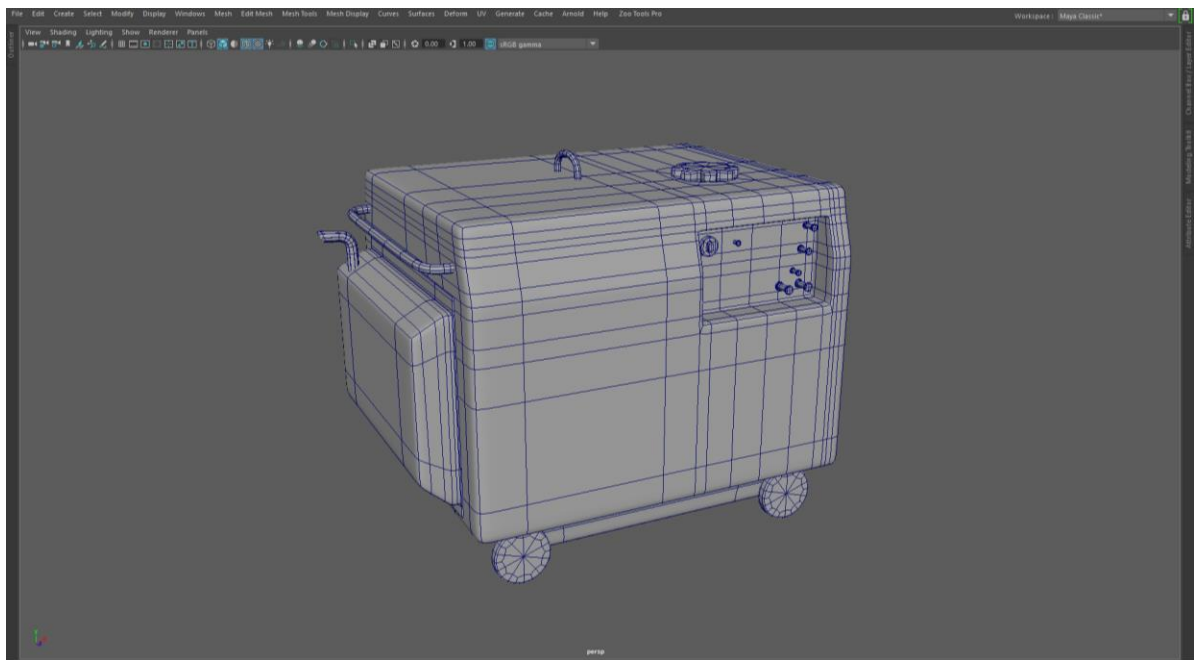


Figure: 2.5 Generator

Smoke exhaust pipe was made by poly-cylinder by using bend (Deform > Nonlinear > bend). Then delete the inner face of the cylinder and extrude a little bit of thickness. And the handling bars are made by poly-cylinder by using bend. Generator wheels are just a cylinder. The fuel tank cape was made by cylinder by extruding every other face. The model of the generator was done with maintained quad.

2.1.3 Stand Fan:

The fan was made for factory environment. The fan measurement should be like 4 feet height. Stand fan has lots of parts. I started modeling from the bottom part of this fan. The bottom part was made by Poly Cylinder. I took a poly cylinder. I scaled it a useful size. Then I extruded the top cap faces and use Insert Edge loops Tools where I need on the cylinder to get the shape of the lower part. Then I took another cylinder for the next part of the stand. Next part was made by the box and cylinder combine and merge vertices with cylinder. Then I had to use Insert edge loop tool for supporting loops. Then next part is where blade attached to the fan. It's just a cylinder its cap was extruded for the shape. Then the next part of this blade of the fan. The blade was made by Polybox subdivide four . Then Positioning that is em into correct order like the collected reference. Then add supporting loops for smooth. Then top back part of the stand fan. It just a cylinder with scaled and position. Topology of the model are maintained at the time of modeling.

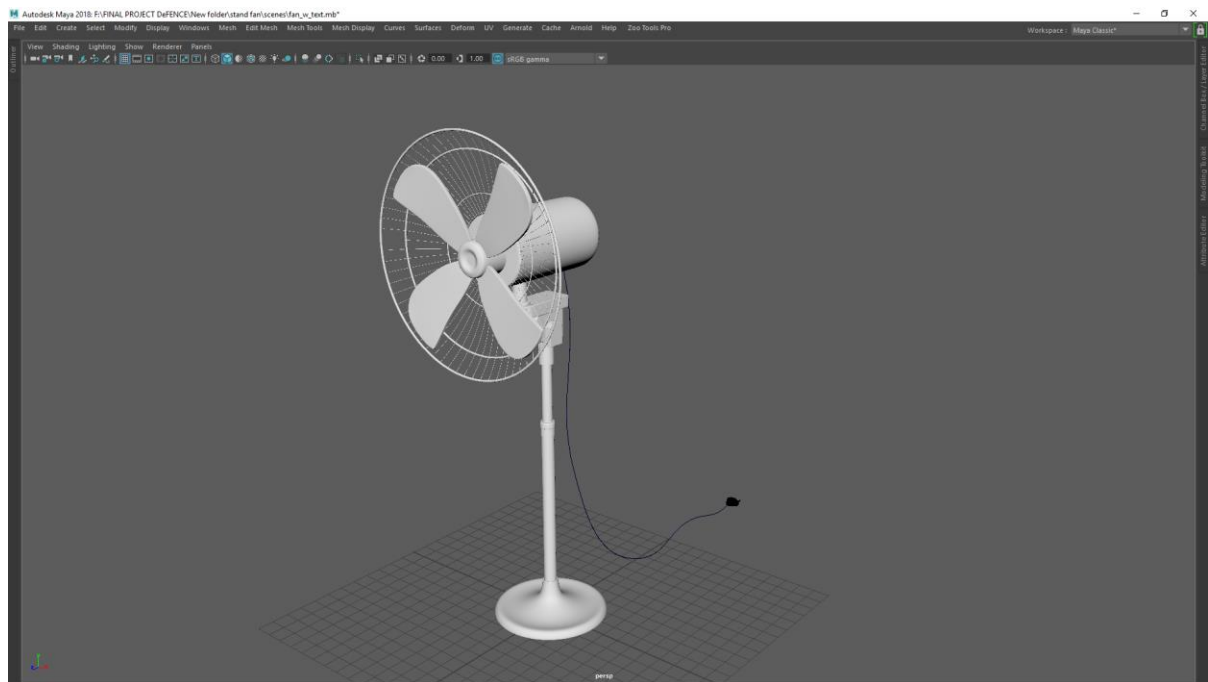


Figure: 2.6 Stand Fan

2.1.4 Carton box:

Carton box was made for factory environment. The carton box measurement was 1.5 feet by 8 inches. It was made by Poly Box. Then I duplicate the top of the face of the box for the flap of the box from (Shift Mouse Right Click > Duplicate face). Then I press (shift+p)for ungroup the face from box. Give the position for flap duplicate the face 3 times. Then set the position

for other flaps and scale them by selecting vertices. Then delete the top face of the box. First combine them together. Then flap vertices and the box vertices merge it together from (Shift+Right Click > Merge vertices > Merge vertices). I repeated the same process to every other flap. Then I select all faces of the box along all flaps then press (Ctrl+E) for extrude for box thickness. Then I select the flap vertices and change pivot point by pressing (D + V). Then rotate it for realistic looks. Then add supporting loops by using Insert Edge Loop Tools. Then I subdivided twice.

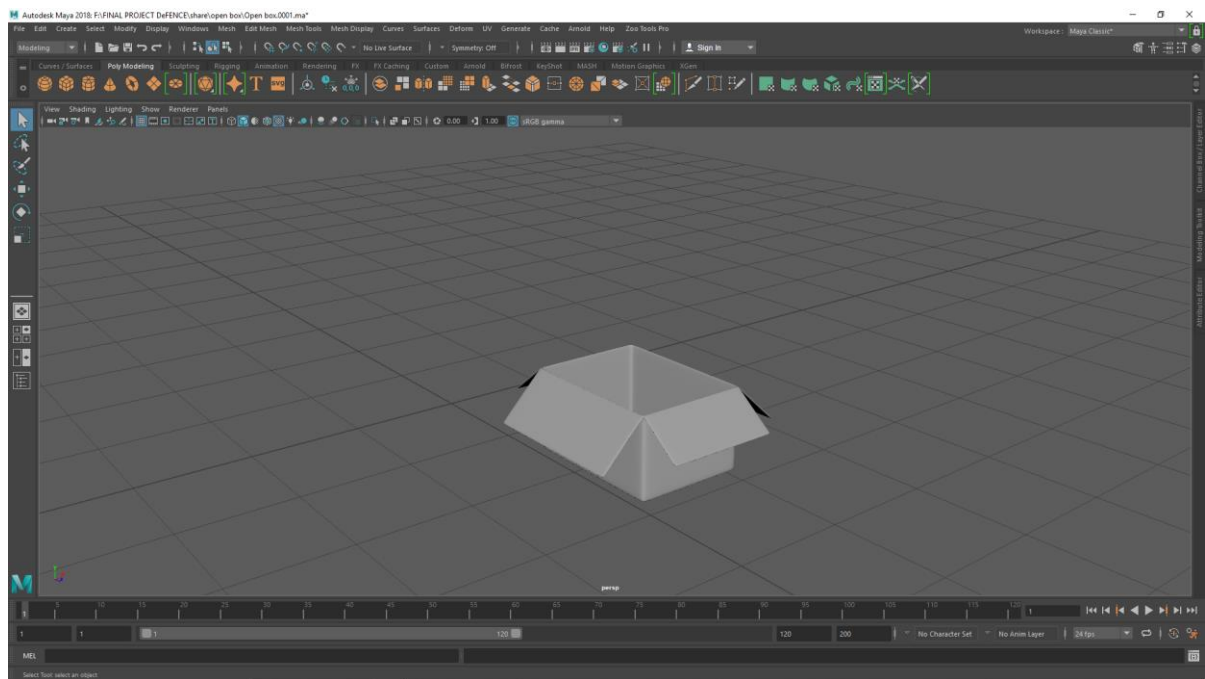


Figure : 2.7 Carton box

2.1.5 Hanging Bulb:

Hanging bulb was made for our Factory Environment. There are two parts . They are bulb and bulb shade . First I collected the reference of old bulb shade and bulb. Bulb shade was made by cylinder. First I took a cylinder by scaling into current shape along with references. Then I extruded the bottom cape of the faces then scale repeat the same process until I got the shape of shader

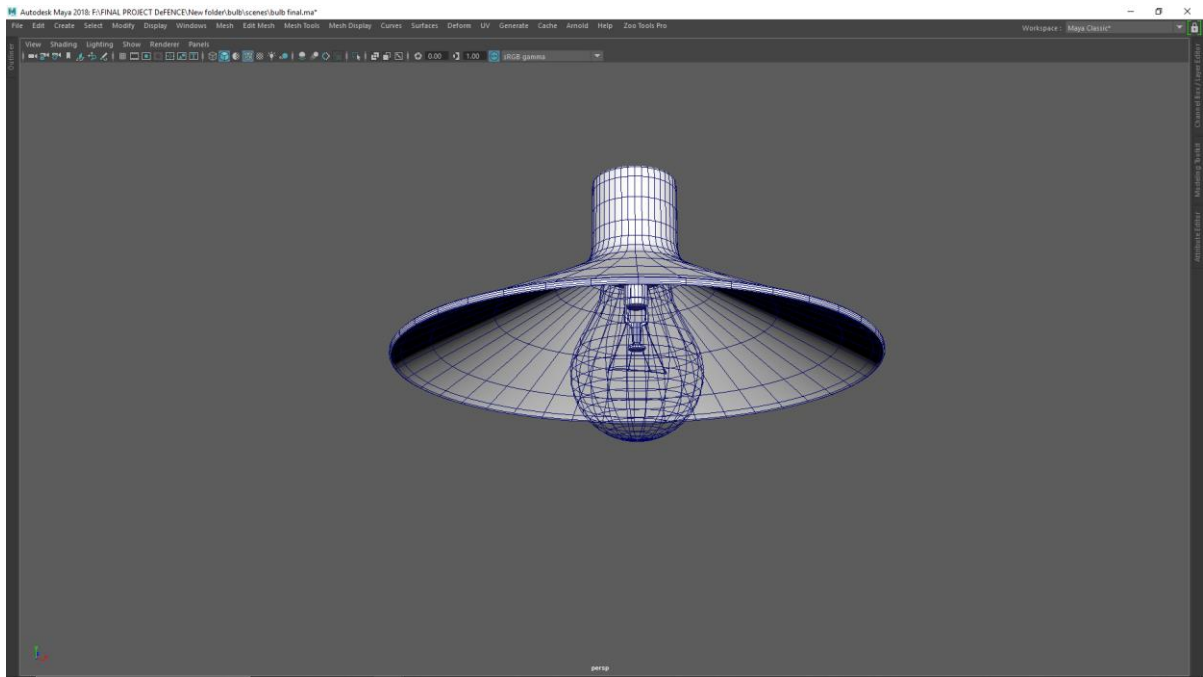


Figure: 2.8 Hanging Bulb

The next part is the bulb. Bulb glass is made by a pSphere. First, I took a sphere then delete the half faces from top the select top of the edge loop extruded and scaled and placed edge according to the reference image. By repeating this process, I got the perfect shape of bulb glass.

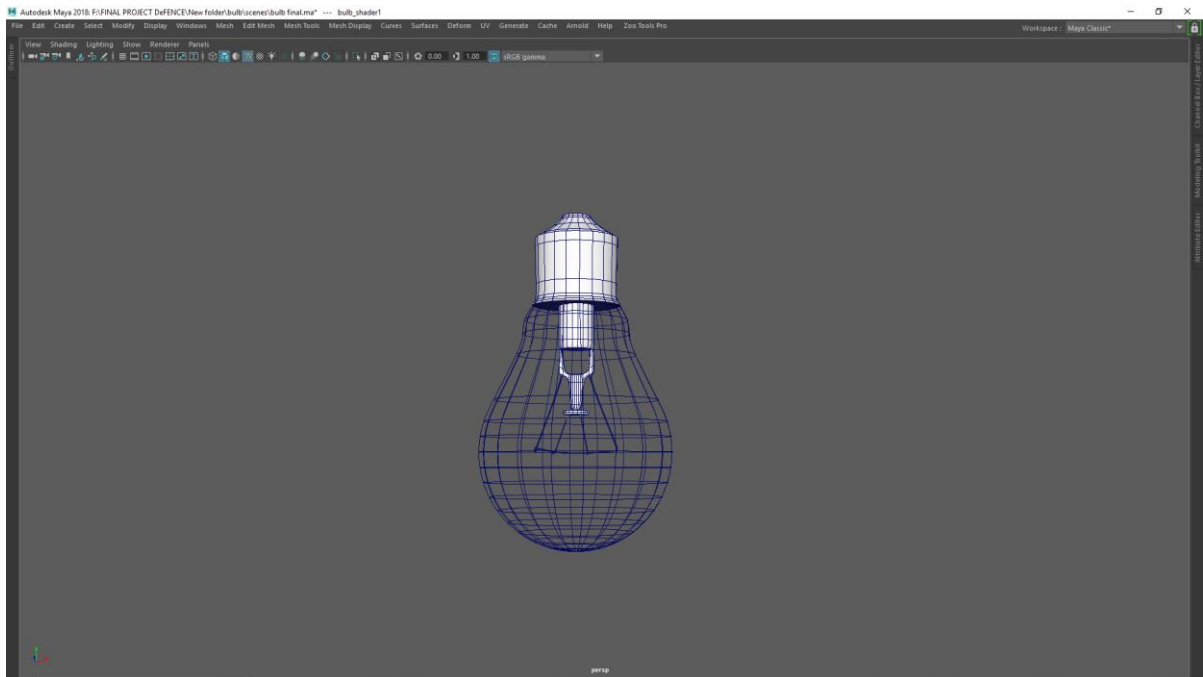


Figure: 2.9 Bulb

Bulb screw element was made by cylinder. Electric foot contact was made by extruding the top cap faces of the cylinder by pressing (ctrl + e). Glass mount also made by cylinder. Cylinder was added edge loops buy using Insert edge loop tool. The select two sided the faces of the extrude according to the reference and placed.

2..1.6 Globe:

The globe was made for classroom environment of our project. There are two parts of the globe. They are globe and globe Stand. The globe it's just a sphere with scaled. Then stand part of the globe. The bottom part of the globe is just a cylinder with scaled. The next part is another cylinder. Cylinder top cap was extruded according to the reference image. The carve part was made from the sphere. Select face on sphere then duplicate the faces from (Shift + Right click + Duplicate faces). Then press (shift + P) for ungroup. Then extrude the faces for thickness then Scaled and extrude (by Pressing ctrl+e) it according to the reference. The holder of globe is duplicating the faces from the globe sphere Then extruded the faces according to the reference image.

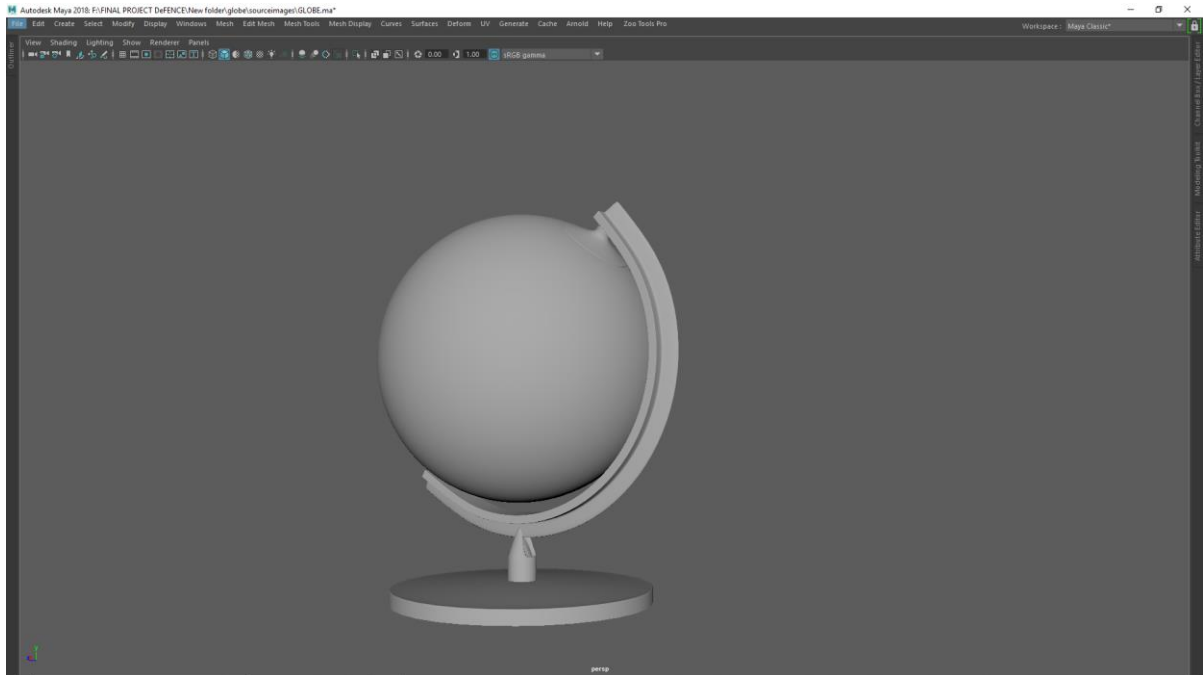


Figure: 2.10 globe

2.1.7 Tree Trunk:

We decided that we are going to use our own stylized tree in our project. I collect some reference of trunk. The tree trunk was made by pCylinder. First, I took a pCylinder subdivided with 8 / 10. Where Should be the branch of the trunk, I added their loops by using Insert Edge loop tools from (Shift + Right Button + Insert Edge loop tool). Then I extruded the faces for brunch and deleted the faces.

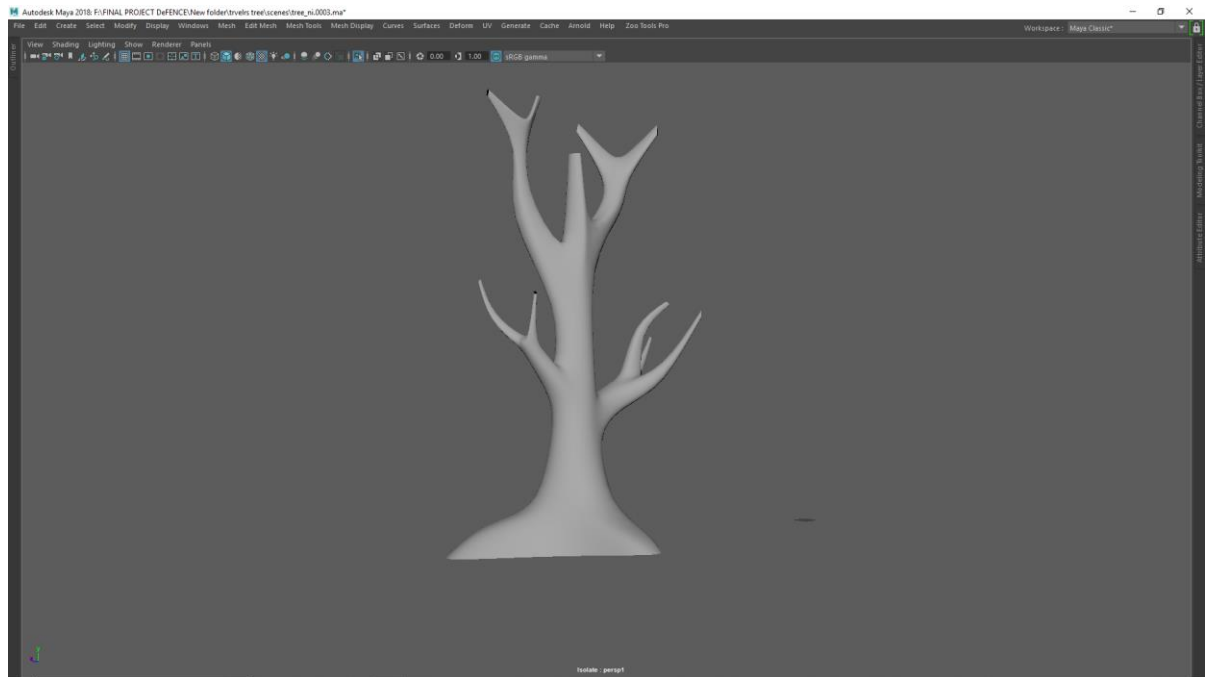


Figure: 2.11 Trunk

Then added edge loops then position then for organic looks. I made four tree trunks by using the same process.

2.1.8 Traveller Tree:

Traveller tree was made School outdoor Environment. There are two parts. Then I started modelling from leaf. First, I took a pBox. Then scaled it. Then I use Insert edge loop for adding edge loops. Then select the face which one inside the 2 edge loops. Then extruded the face. Then I go to the vertex mode placed them by selecting vertices. So that it looks like a leaf. Then added loops on leaf vertically where the cut should necessary. Then I cut the faces inside the edge loops which one I created recently. Then Bridge Upper and lower edge from (Shift + Right Button > Bridge). I repeat the process where I need to cut. When the leaf was complete. I took a pCylinder placed it with necessary scaled. Then I select the leaf and change the pivot point to on cylinder. Then I duplicate it by pressing (Shift + d). Then I rotate it then I press (shift +d). It will place all the leaf same rotation on same proportion. Then I randomized for looks organic. Then I selected the individual leaf randomised it by giving the different cut on them and by moving vertices.

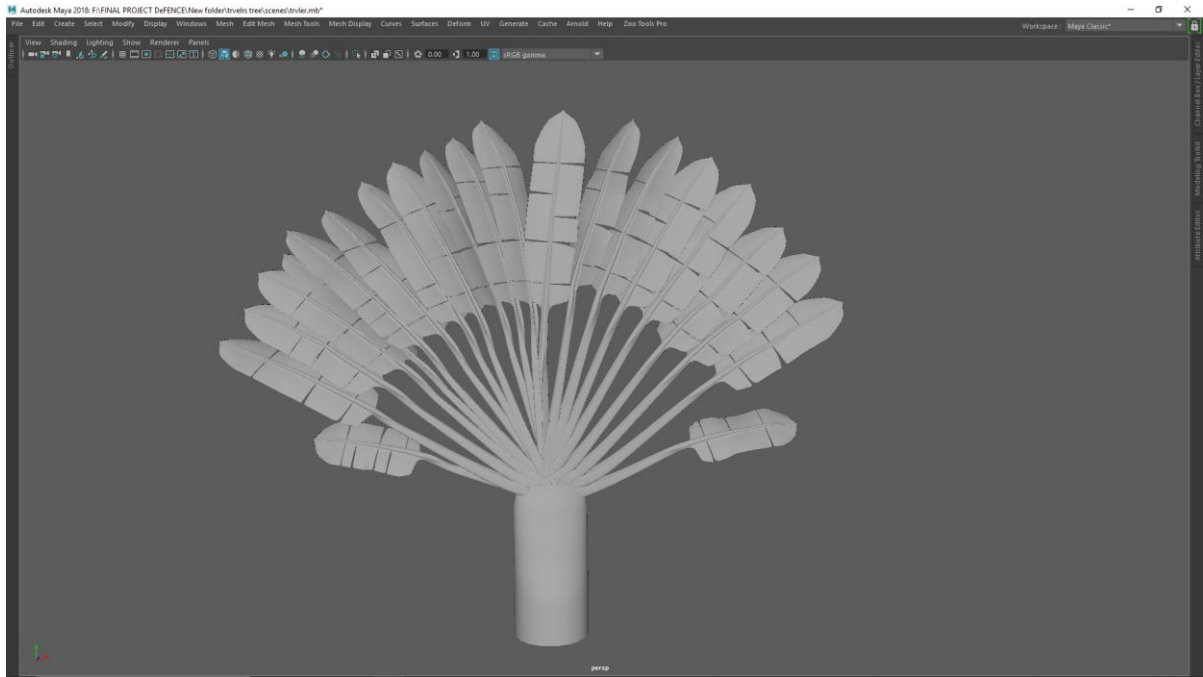


Figure: 2.12 Traveller tree

2.1.9 Gamcha:

Gamcha was made for our factory environment. It was made by a plane subdivided by 50/60. The plane placed on the rope. Added cloth from (fx menu set > nCloth > Create nCloth. The rope set as a passive collider. The simulated the plane then which frame I like to use as a gamcha on that frame I clean history of plane.

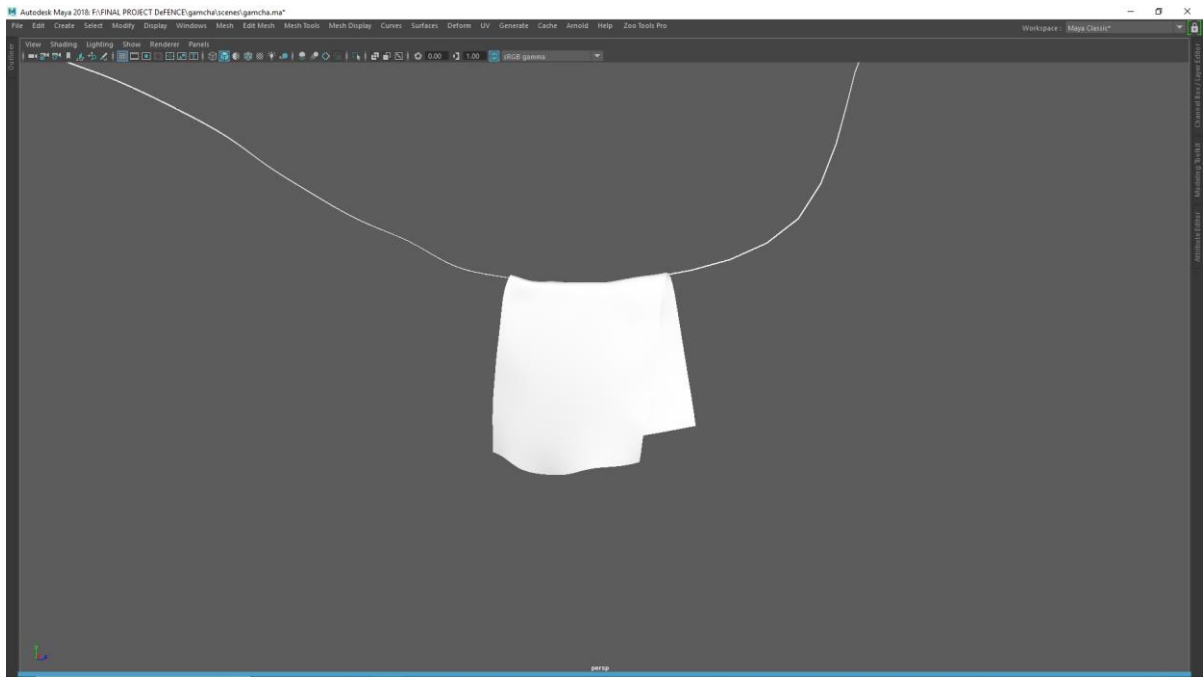


Figure: 2.13 Gamcha

2.1.10 Character Modelling:

I started the modeling Body part. pCylinder Subdivide with 12 /1. Head a was made from pSphere subdivided with 12 /8. Hand was made from cylinder subdivide with 6 \ 6. And legs made from pCylinder Subdivide with 8 /8.

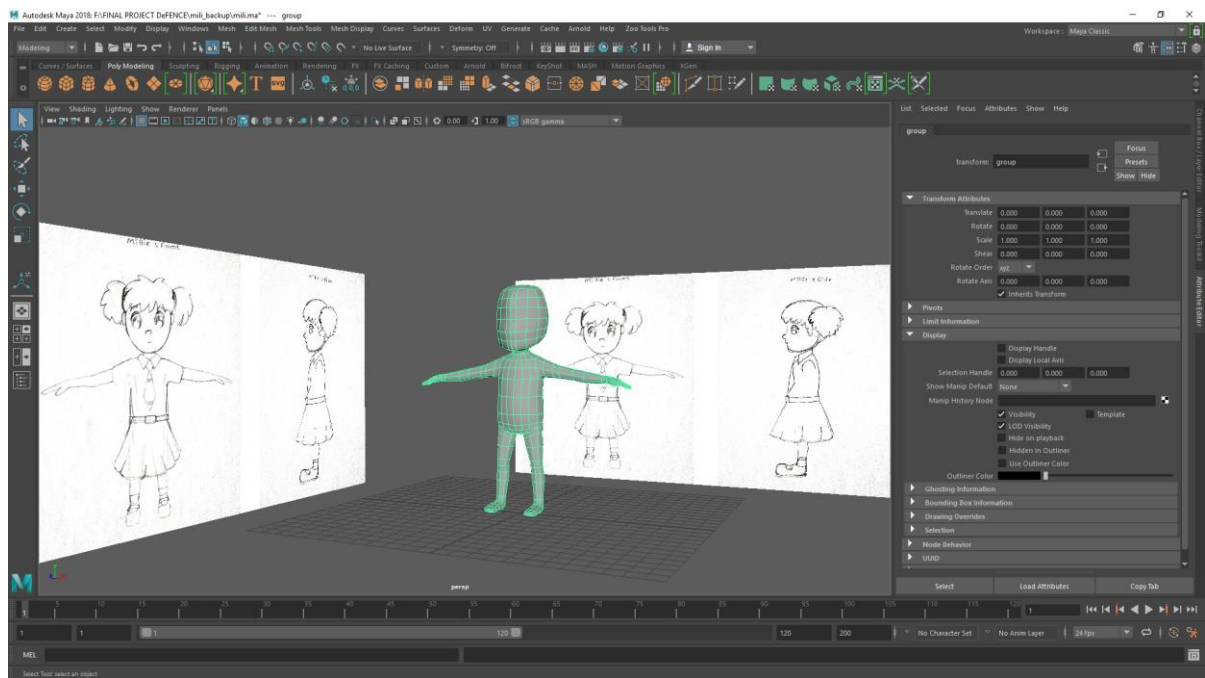


Figure : 2.14 character modeling mili

Then i got the primary body shape of the character. Then I had to merge the vertices to the body. The body will be deleted from the middle it can be right side or left side by selecting face Then I use duplicate special tools Scale vale -1 From (Menu bar > edit > Duplicate > Special tools).

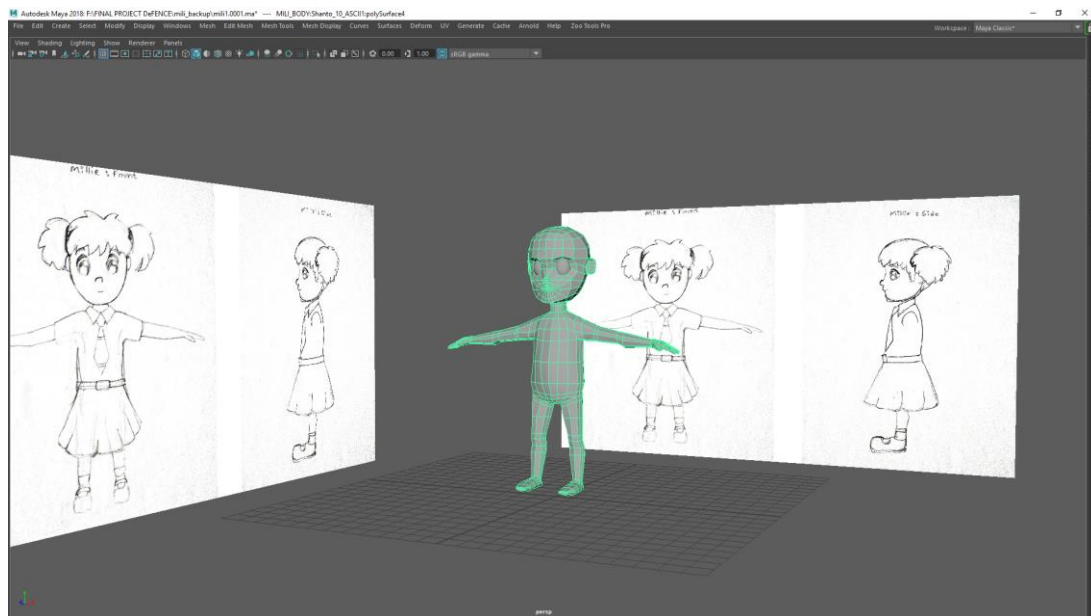


Figure: 2.15 Character Modeling Mili

Because The model was so primary level. I had to Add some details by sculpting by using Sculpt Geometric tools There has some few brushes Grab tool, relax tools and smooth

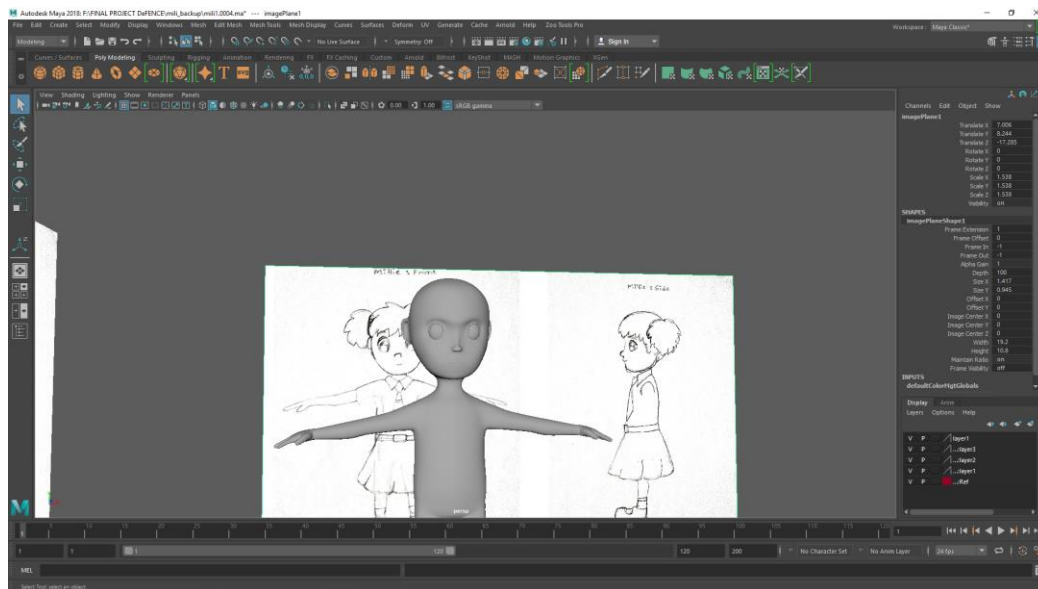


Figure: 2.16 Character modeling Mili

Added loops By using Multi-Cut tools. There the joint deforms.

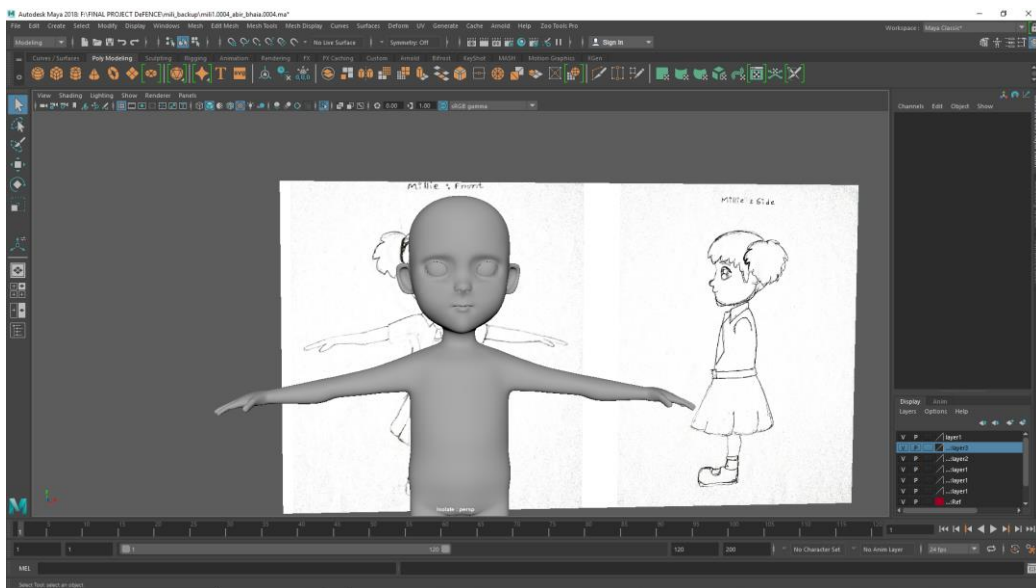


Figure: 2.17 Mili Body.

The dress was made from Duplicating body and deleting the faces of body. The Skirt was made by pCylinder. First, I gave the position of top part with Wrist then I select the edge Then scale it down every other one vertical edge. The smooth the I got the shape of Skirt. The Belt as made from duplicating the faces from skirt.



Figure: 2.18 Mili Dress

There i had finished the complete character model . the model is now ready for uv Unwrap .

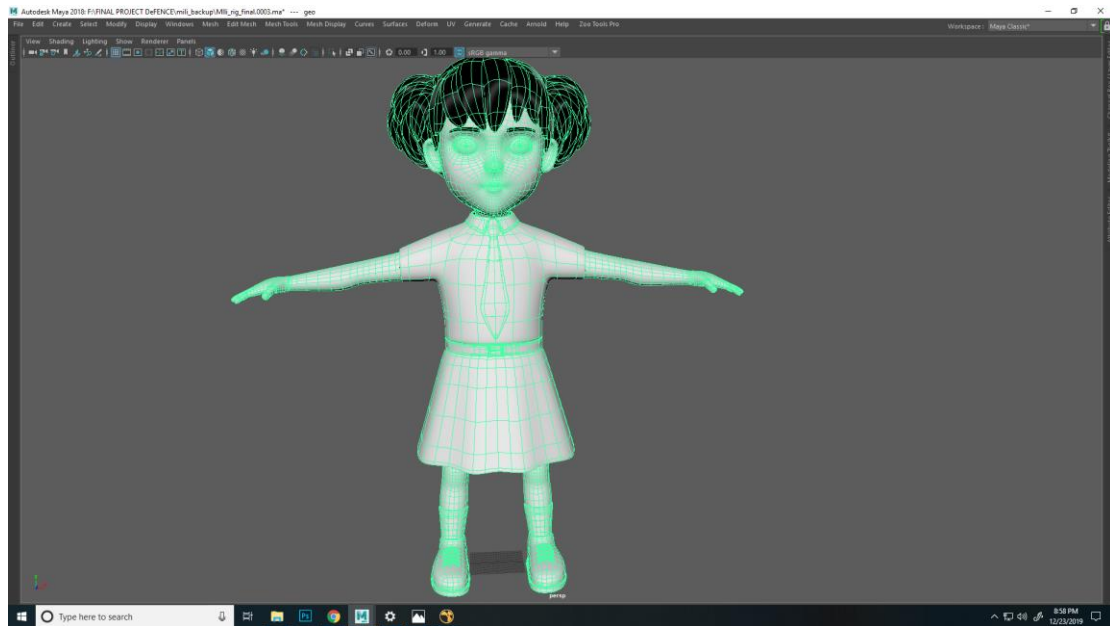


Figure: 2.19 Mili complete model

The topology of the character are maintained. There is no triangulate, or Egon. Ever faces are quads.

2.2 UV Unwrap:

Every part of this bag had to be unwrapped before texturing. First I selected the part of the bag then which I unwrapped first this part I made isolated. Then I find the correct edge for unfold. Because the seam of texture should not be caught on camera. Then I selected the edge then I pressed Shift + X for cut the edge for unfold.

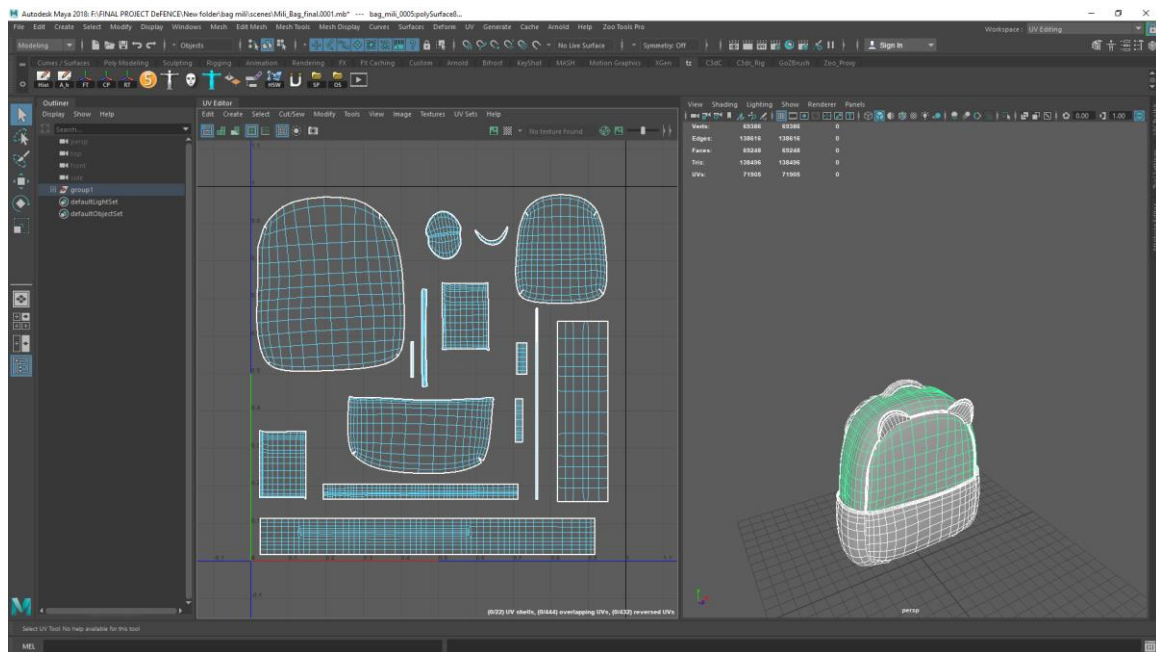


Figure 2.20 UV Mapping

Then I select the shell and pressed (Ctrl + U). Then I made a layout. And took a snapshot

2.2.1 Generator:

There are 8 components of Generator. All of the components should be unwrapped before texturing. First, I select the edge of any component where I want to make a seam and I will unfold perfectly. After selecting the edges press (Shift) for cut the edge. Then unfold from the first (Shift + Right Click > unfold > Unfold along U) then (unfold along V). I had to repeat the whole process for every other component. Then I had to make the layout into 0 to 1 space. Then I

Select all the component UV and press (Ctrl + L) for layout. Then select generator main body upscale its little bit. For generator body Texel density for detailed texture.

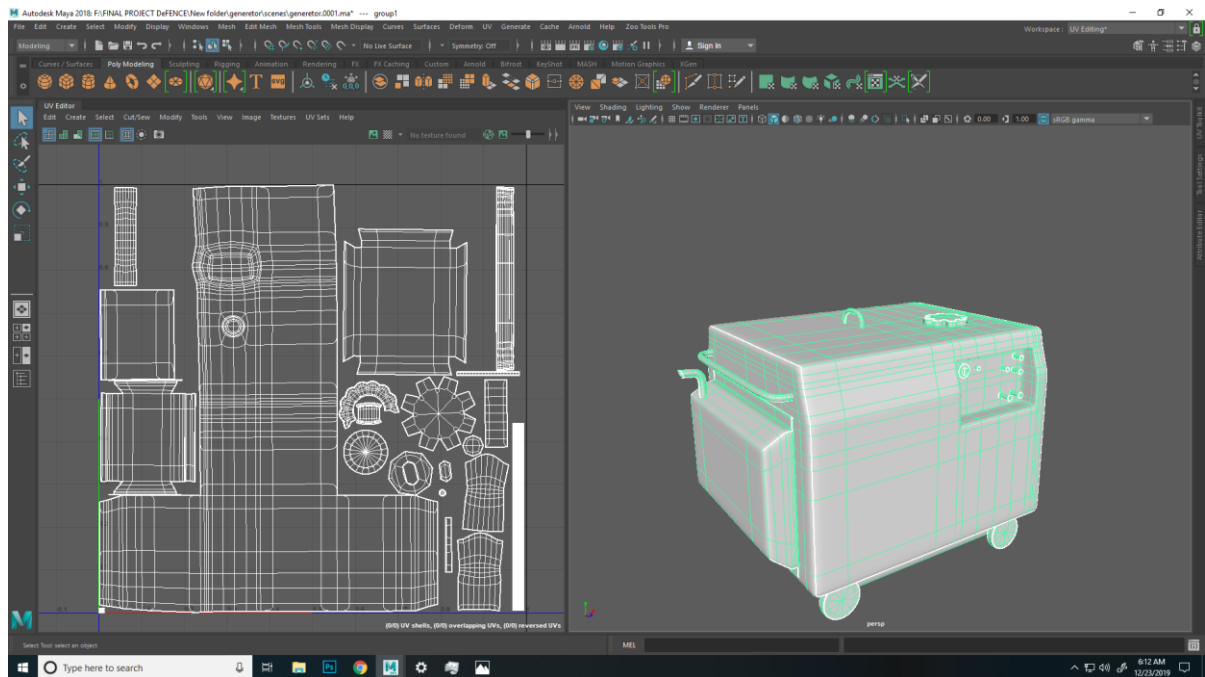


Figure 2.21 UV Unwrapping Generator

2.2.2 Stand Fan:

Stand fans have lots of components. First, I select the edge of any component where I want to make seem to unfold perfectly. I had to find the perfect edge for unfold After selecting the edges press (Shift+x) for cut the edge. Sometimes it works on normal unfold sometimes its didn't. Because of this I had to use (Shift + Right Click > unfold > Unfold along U) then (unfold along V). Then unfold from at first (Shift + Right Click > unfold > Unfold along U) then (unfold along V). I had to repeat the whole process for every other component. Then I made a layout on 0 to 1 space and the case of fan on 1 to 2 space its call UDMI for batter Texel density for texturing.

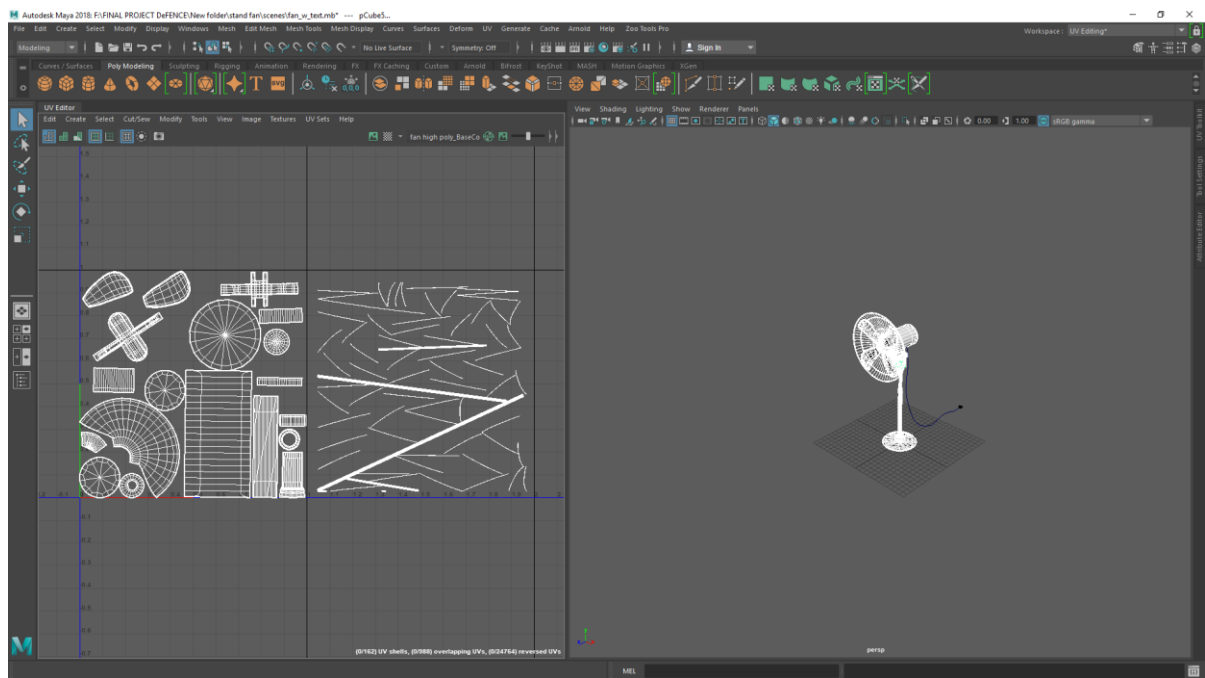


Figure 2.23 UV Unwrapping Stand Fan

2.2.3 Bulb and Bulb shader:

First, I found edge where I want to make seem for texturing, press (Shift+x) for cut the edge. The I press (Ctrl+U) for unfold . After repeating the same process Select all the UVs press (Ctrl + L) for layout into the 0-1 space.

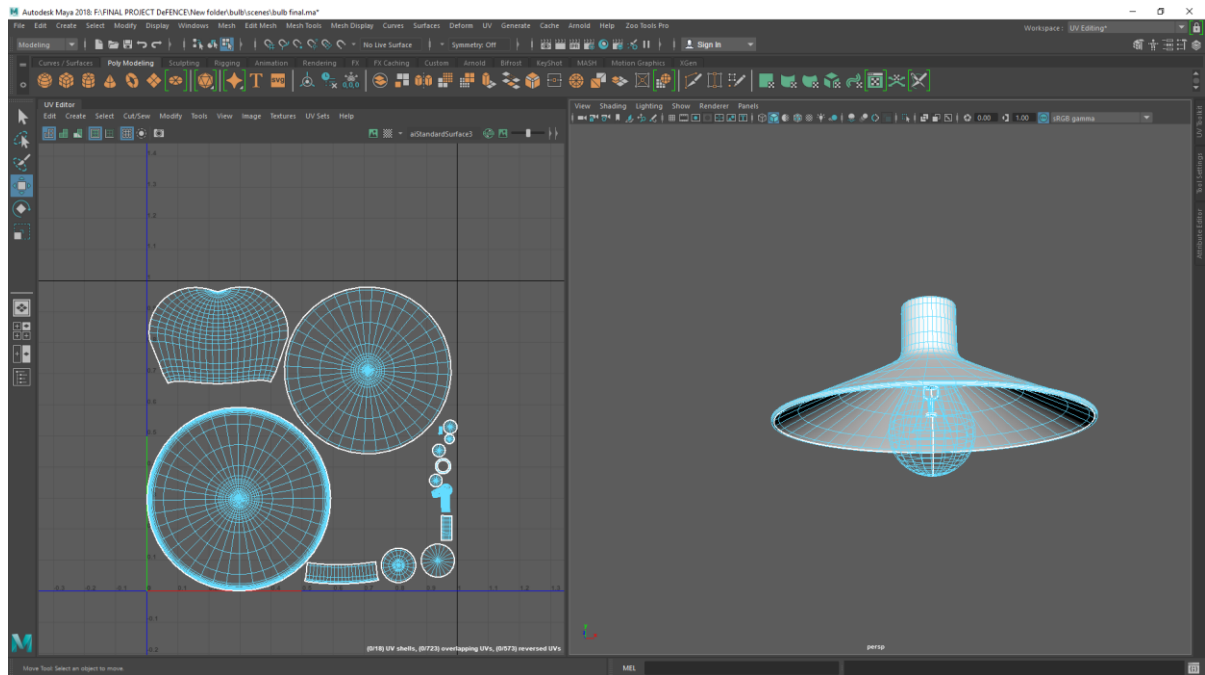


Figure: 2.24 UV Unwrapping Bulb and Bulb Shader

2.2.4 Trunk: Unwrap :

Trunk Unwrapping was challenging > where the branches started, I made a seam on trunk. I cut by pressing (Shift + x). Then I press (ctrl+u) for unfold .Then create a layout. And move the on different UDMI its for different trunk.

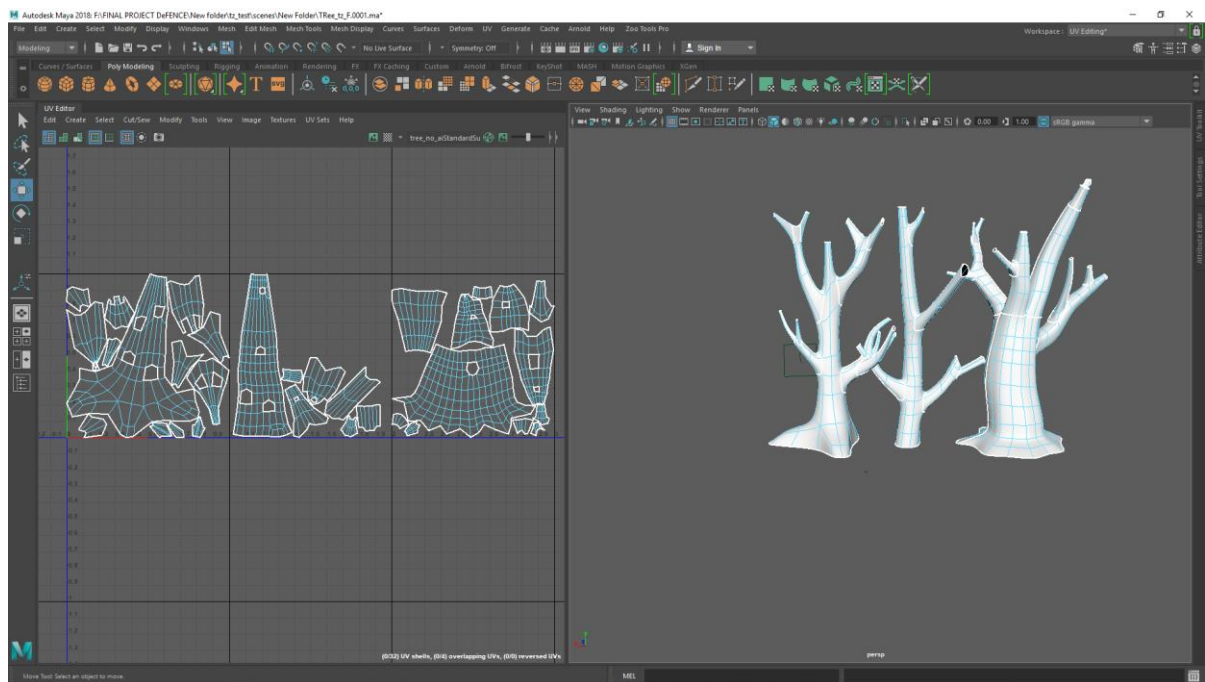


Figure : 2.25 UV Unwrapping Trunks

2.2.5 Traveller tree:

Traveller tree has twenty leaves. And They were different from another. Because of this I had to Unwarp all the leaves individually. I found one edge loops I select that edge Press (Shift+x) for cut that edge and press (ctrl+u) for unfold. I had to repeat the whole process for every other leaves. Then I used Two UDMI tiles for the leaves . The trunk 1 UDMI tile for batter Texel density. Because I needed the batter texture resolution of trunk while texturing.

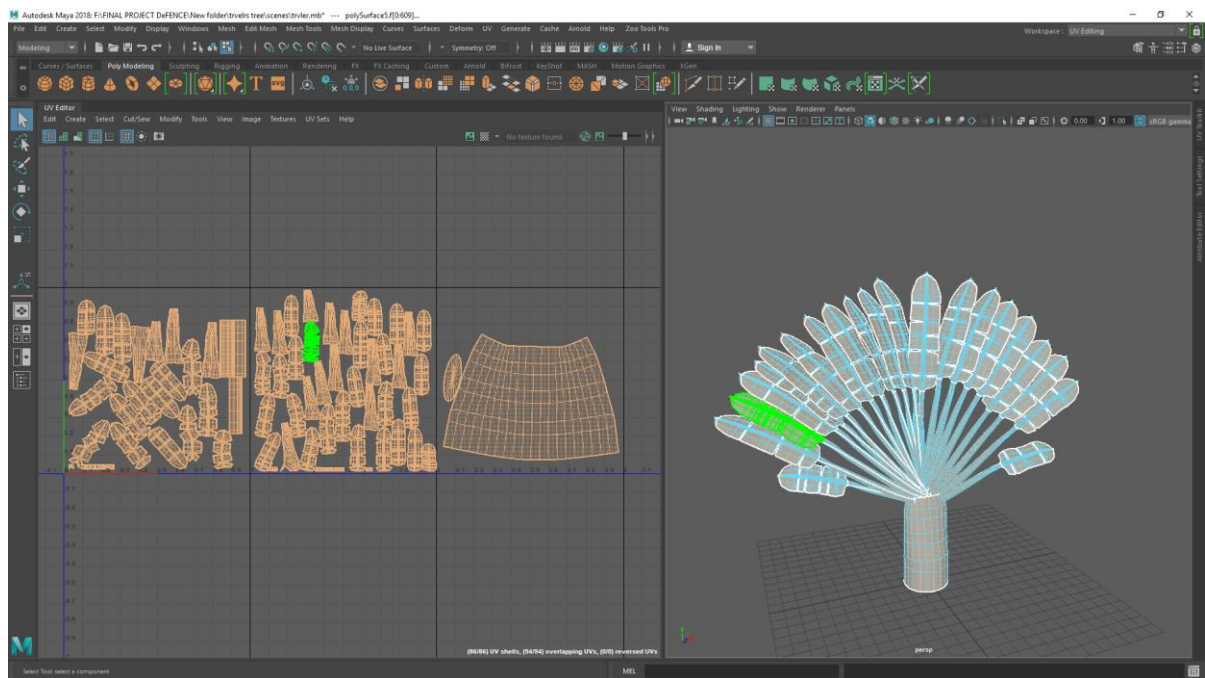


Figure 2.26 UV Unwrapping Traveller tree

2.2,6 Glove:

Glove had two parts for unwrap. Glove and stand. First, I found edge where I want to make seam for texturing, press (Shift+x) for cut the edge. Then I press (ctrl+u) for unfold. All Individual parts i had to unfold by following those steps.

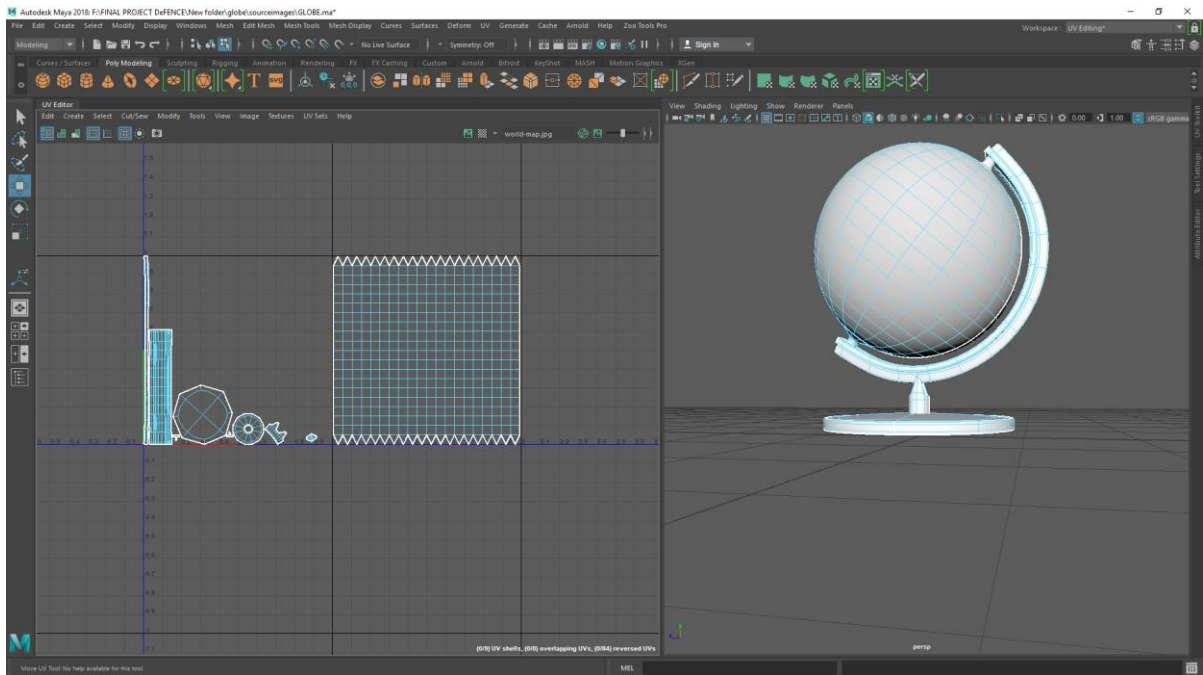


Figure 2.27 UV Unwrapping Trunks

2.2.7 Carton box :

I found one edge loops I select that edge Press (Shift+x) for cut that edge and press (ctrl+u) for unfold. I had to repeat the whole process for every other leaf.

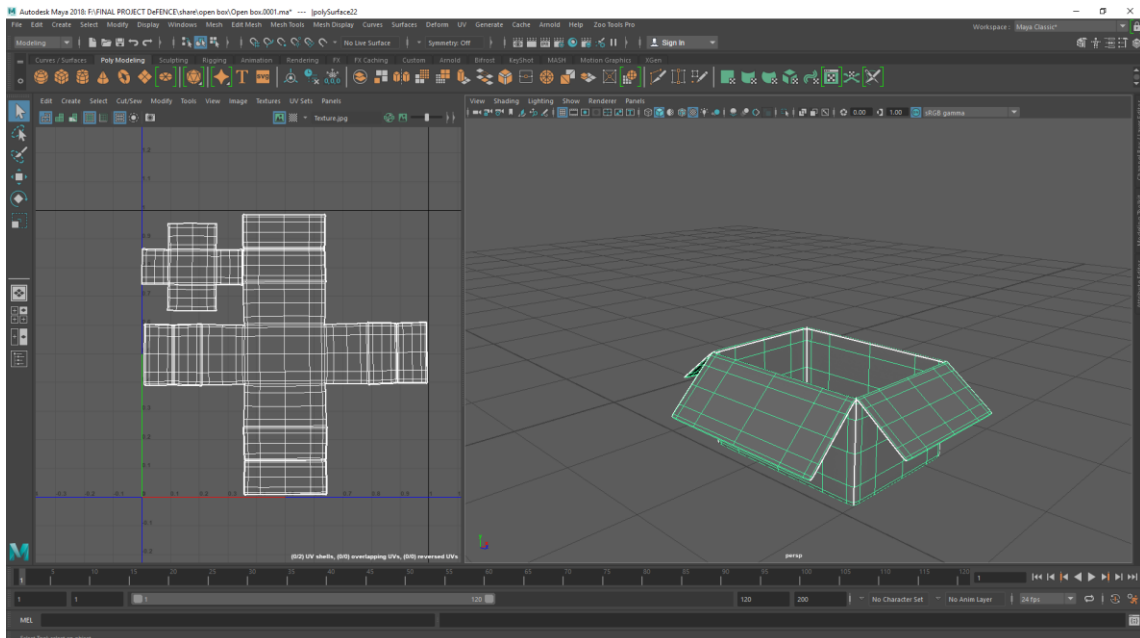


Figure: 2.28 UV Unwrapping Carton Box

2.2.8 Character UV:

All of the Body parts should be unwrapped before texturing. First, I select the edge of any component where I want to make seam and I will unfold perfectly.

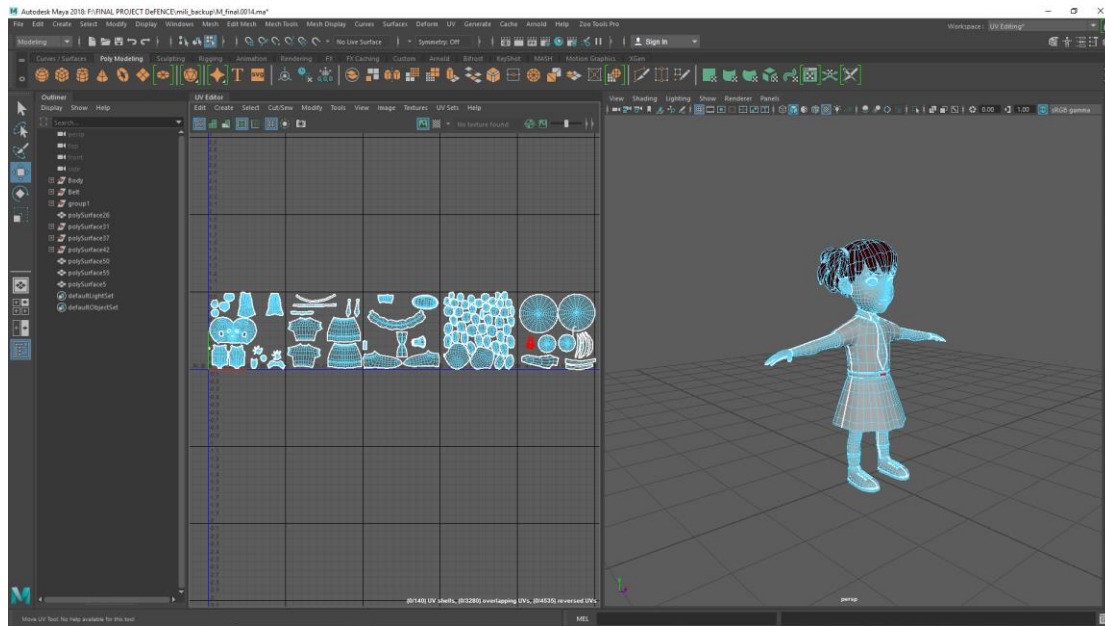


Figure 2.29 Mili Unwarping

After selecting the edges press (Shift+x) for cut the edge. Then unfold from at first (Shift + Right Click > unfold > Unfold along U) then (unfold along V). I had to repeat the whole process for every other Body part. Then I had to make layout into 0 to 1 space only body. Next UDMI for cloths. Then next UDMI for hair and last admi for eyes, eyebrows etc.

2.3 Texturing

2.3.1 Bag:

First, I take a snapshot of UV layout. Then I import on Photoshop. I make the Design on Adobe Illustrator.

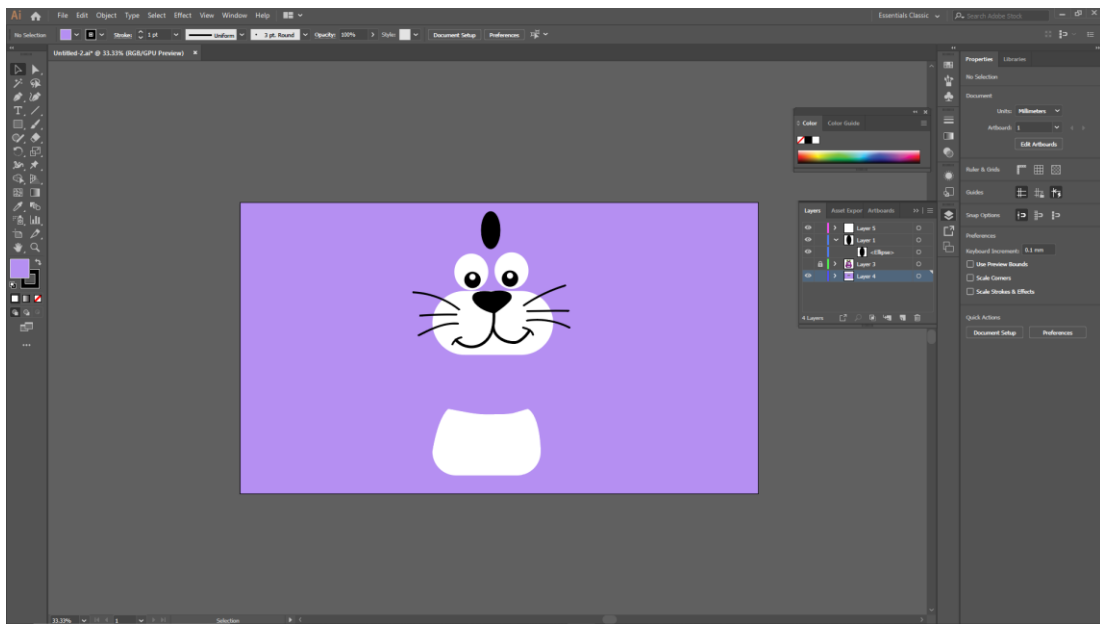


Figure 2.30 School Bag texturing

That design import on photoshop as a smart object. For the base colour I choose Purple. and then I placed the design where it will be on UV. And I choose the ear of the bag will be light blue.

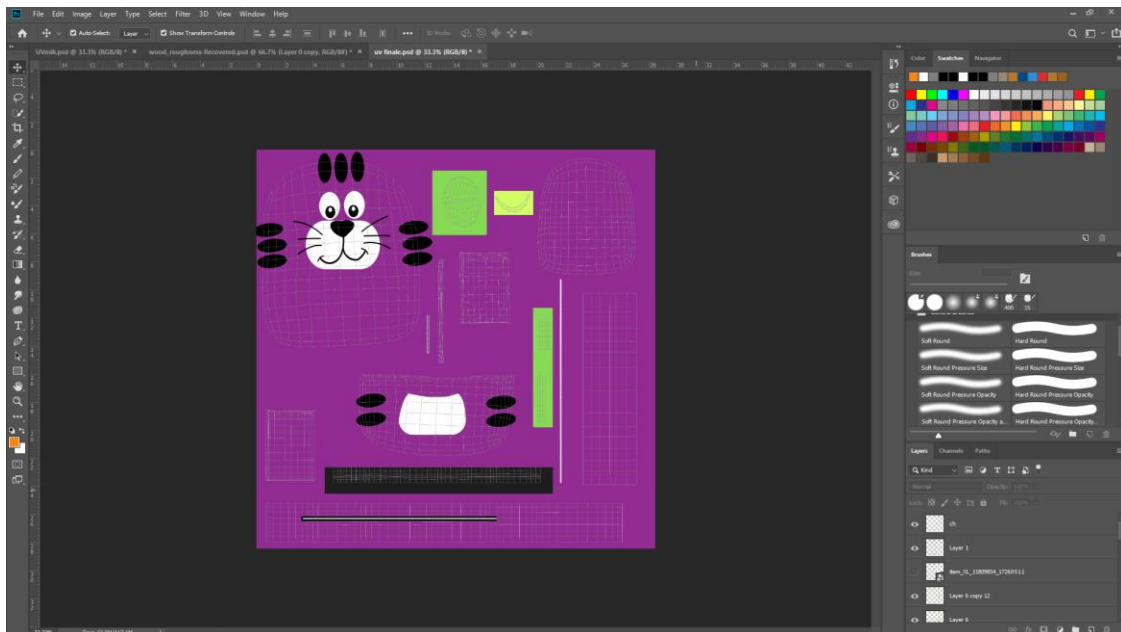


Figure: 2.31 School Bag texturing

From Photoshop the image exports a jpg file. On the bag I apply AiStandardsurface and apply the jpg texture.

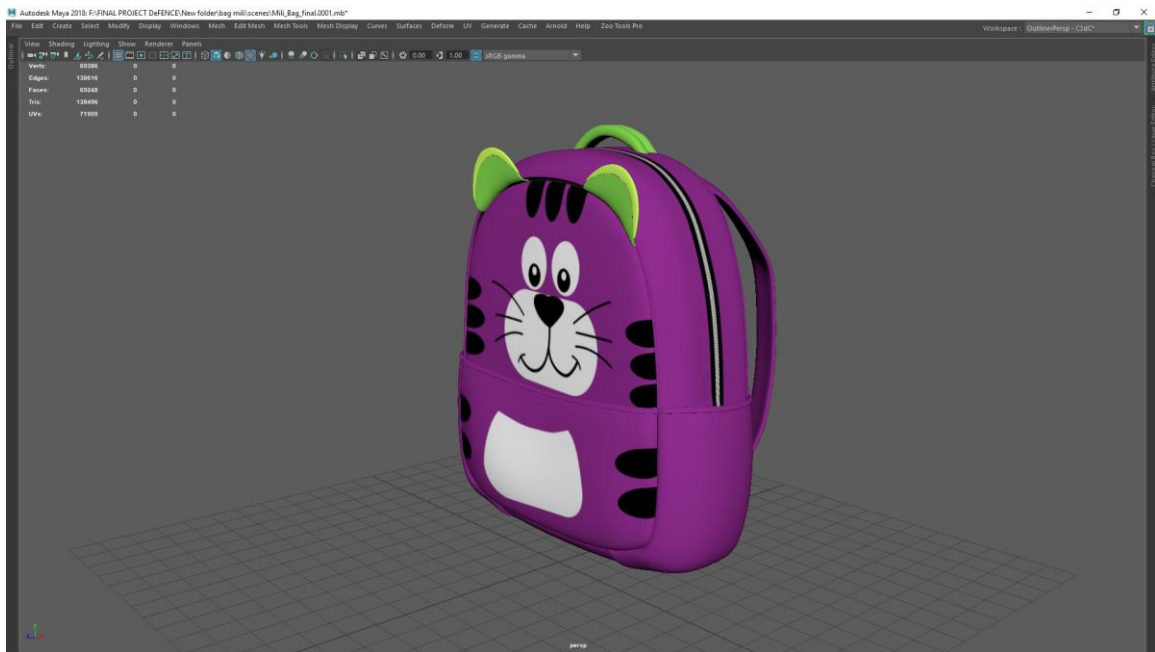


Figure 2.32 School Bag texturing

2.3.2 Generator:

After UV when the Generator ready for texture. I duplicated the generator Then subdivided the generator. The high poly generator export as obj. Format. Then import the ob. file from Substance Painter^[4]. Then bake texture. I used substances Default smart material Machinery. Then add feel layer on then added grunge on it. Collect a Generator logo. Edit as it like old from Adobe Photoshop^[5]. make an alpha map of the generator logo import them Substance painter^[4].

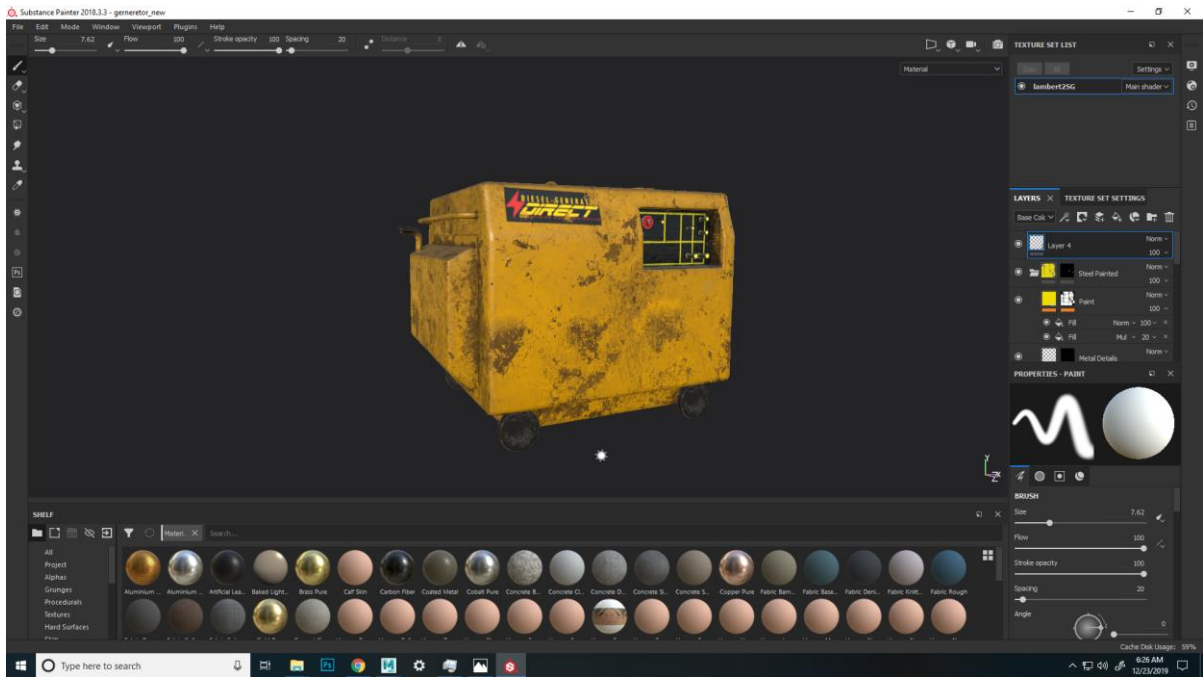


Figure 2.33 Generator Texturing

Added fill layer from paste the logo on generator using brush tools. Added some grunge on the logo. Then export for “Autodesk Maya”^[8] for “Arnold”^[7] from (Self menu > file > Export Textures > Config > Arnold 5 AiStandard). Then set the location and Then export.



Figure 2.34 Generator Render Image.

Import the texture on “Autodesk Maya” [8]. Import Base colour, Metalness, Roughness, Specular, and Bump. For check the texture open render view of Arnold.

2.3.3 Character Texturing:

I took a snapshot of UV unwrap. I import the image on photoshop. Then I collected skin colour panel then I picked colour by eye picker tools. Then press (Ctrl + Backspace) for add foreground colour. Then for the lips and chicks I painted the light pink colour paint where it necessary.

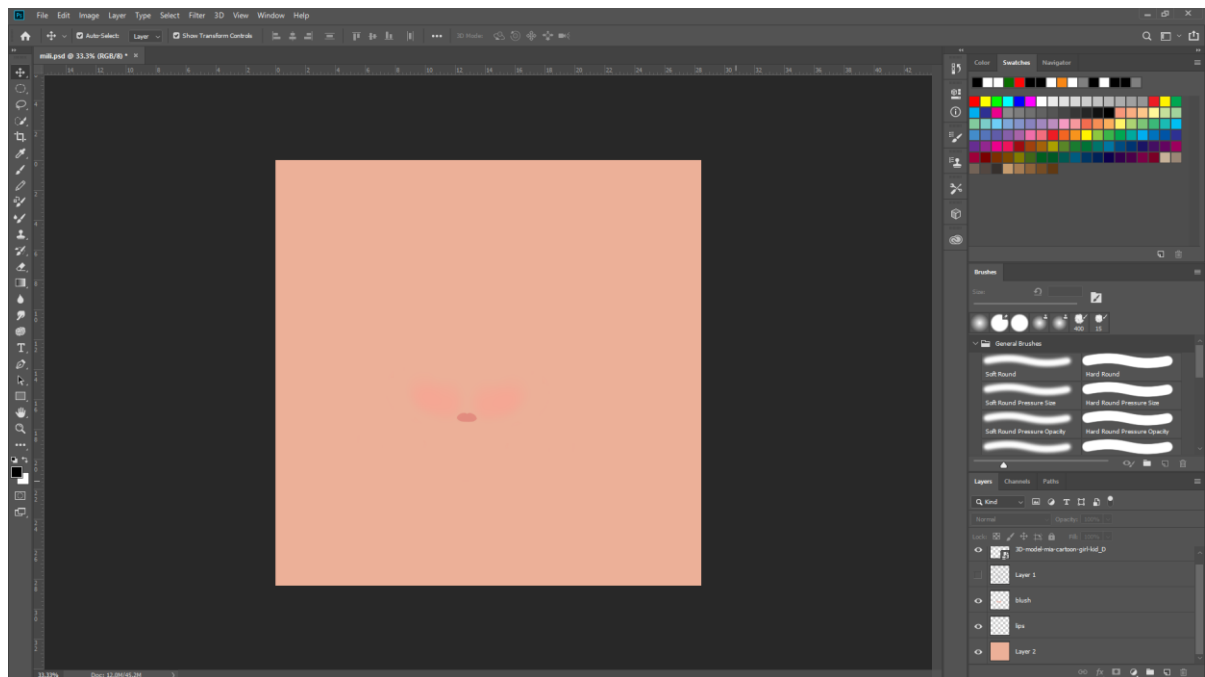


Figure 2.35 Mili Skin Texture

Then I exported the Photoshop[] file export as png image. Then I added AiStandardSurface. As A base material I plugged the png image.

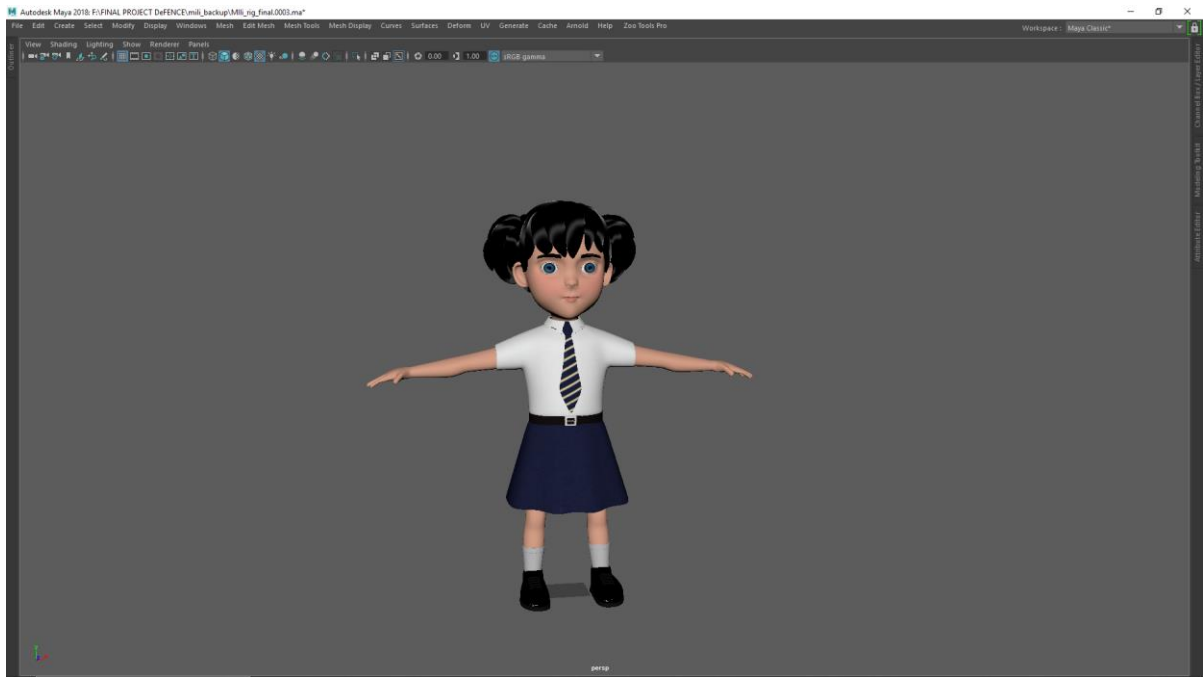


Figure 2.36 Mili 's and her dress Texture Assigned.

2.3.4 Gamcha:

After UV Unwrap. I took snap short of UV. Import The picture on Photoshop. Collect texture of a gamcha from “daraz.com”^[1]. Then i made alpha map and roughness map.

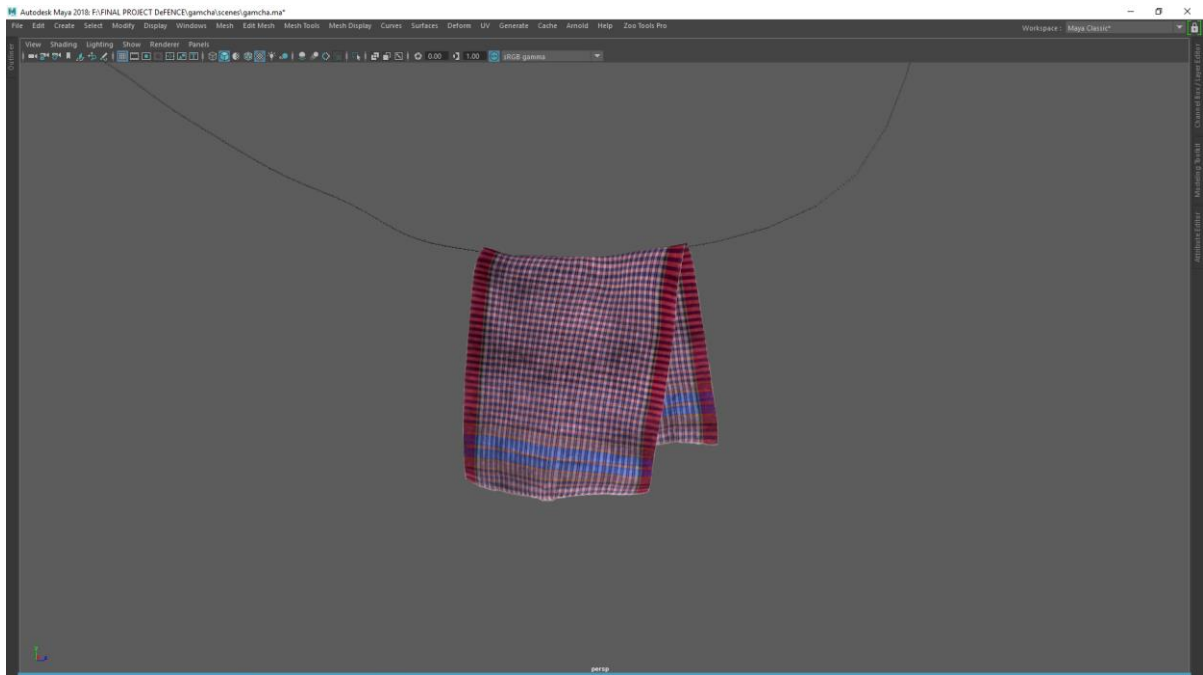


Figure 2.37 Gamcha texturing

2.3.5 Slide:

After UV when the slide ready for texture. I duplicated the slide Then subdivided the Slide. The high poly slide export as obj. Format. Then import the ob. file from Substance Painter^[4].Then bake texture . I used substances Default smart material Machinery on metal part. The other part I use Painted plastic metal. Then added some grunge.

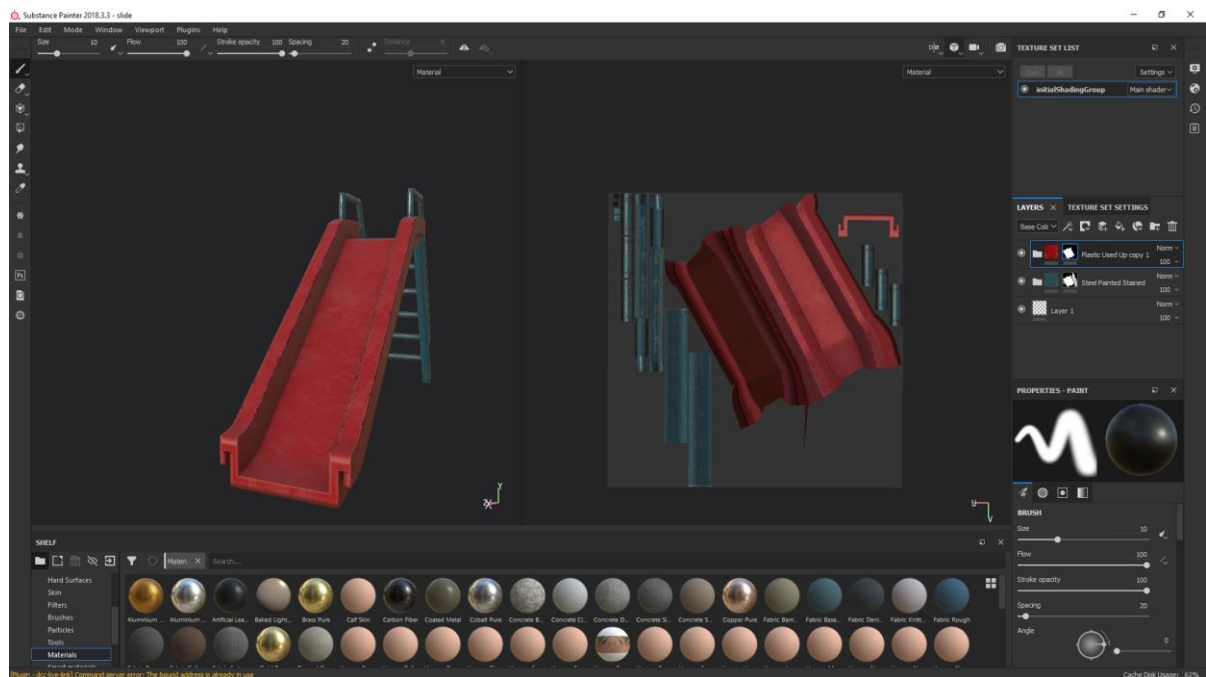


Figure 2.38 Slide Texting on Substance Painter

2.3.6 Swing:

After UV when the Swing ready for texture. I duplicated the swing Then subdivided the Swing. The high poly Swing export as ob. format. Then import the obj file from Substance Painter^[4]. Then bake texture. I used Substances Painter [] Default smart material Machinery for metal part. Then add feel layer on then added grunge on it. Added fill layer from paste the logo on generator using brush tools. Added some grunge on the logo. Then export for “Autodesk Maya”^[8] for “Arnold”^[7] from (Self menu > file > Export Textures > Config > Arnold 5 Aistandard).

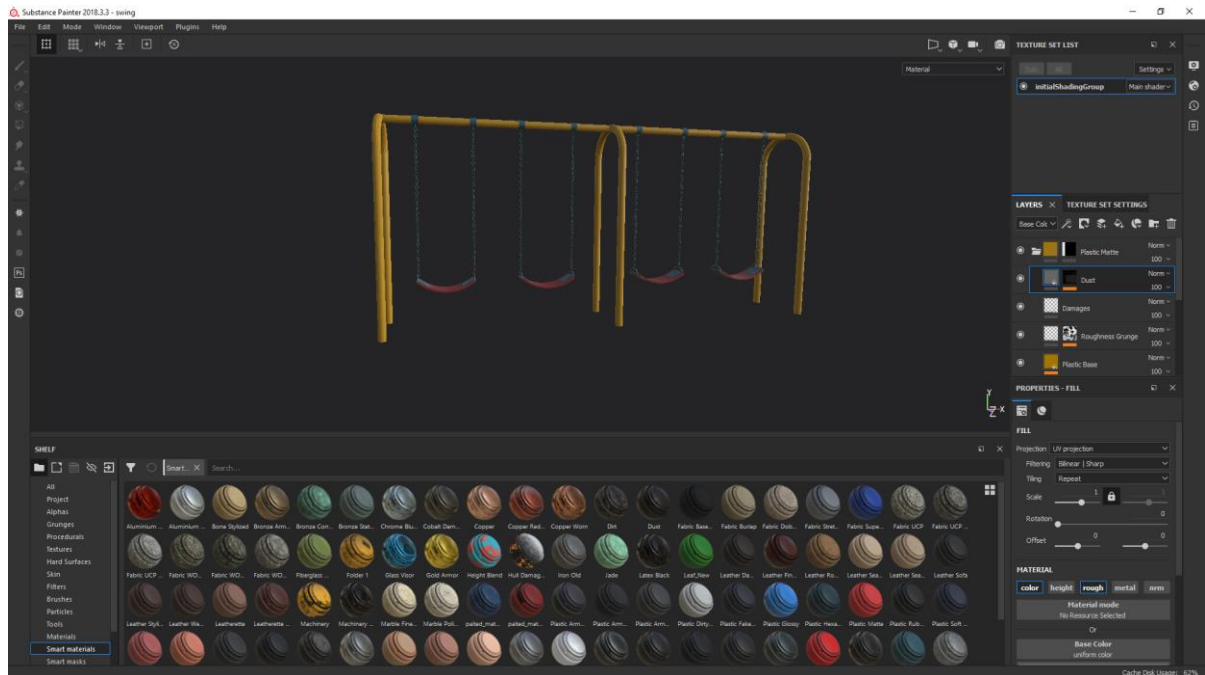


Figure 2.39 Swing Texturing on Substance Painter

2.3.7.Cabinet:

After UV when the Cabinet ready for texture. I duplicated the cabinet Then subdivided the cabinet Substance Painter^[4].The high poly cabinet export as obj format. Then import the obj file from Substance Painter^[4].

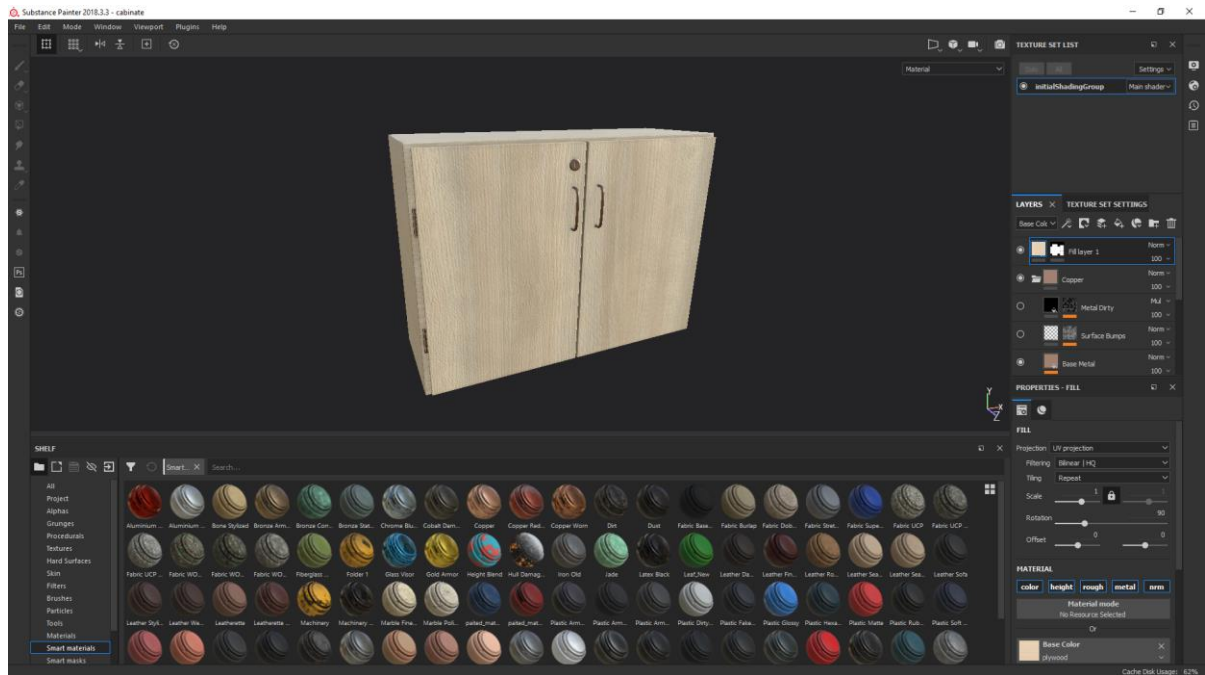


Figure 2.40 Cabinet Texting on Substance Painter

Collect texture of a gamcha from “Texture.com” [11]. Then I made alpha map and roughness map and Normal map. Import texture of “Substance Painter” [8] on the current shelf . Apply the texture on the cabinet and the metal part was Copper default material.

2.3.8 Hanging bulb:

Hanging Bulb bake the texture after import the object of obj format. Then apply Machinery Smart material. Remove the default grunges and some light grunges. Change the base colour yellow to blue. Then export and import the texture on similar process.

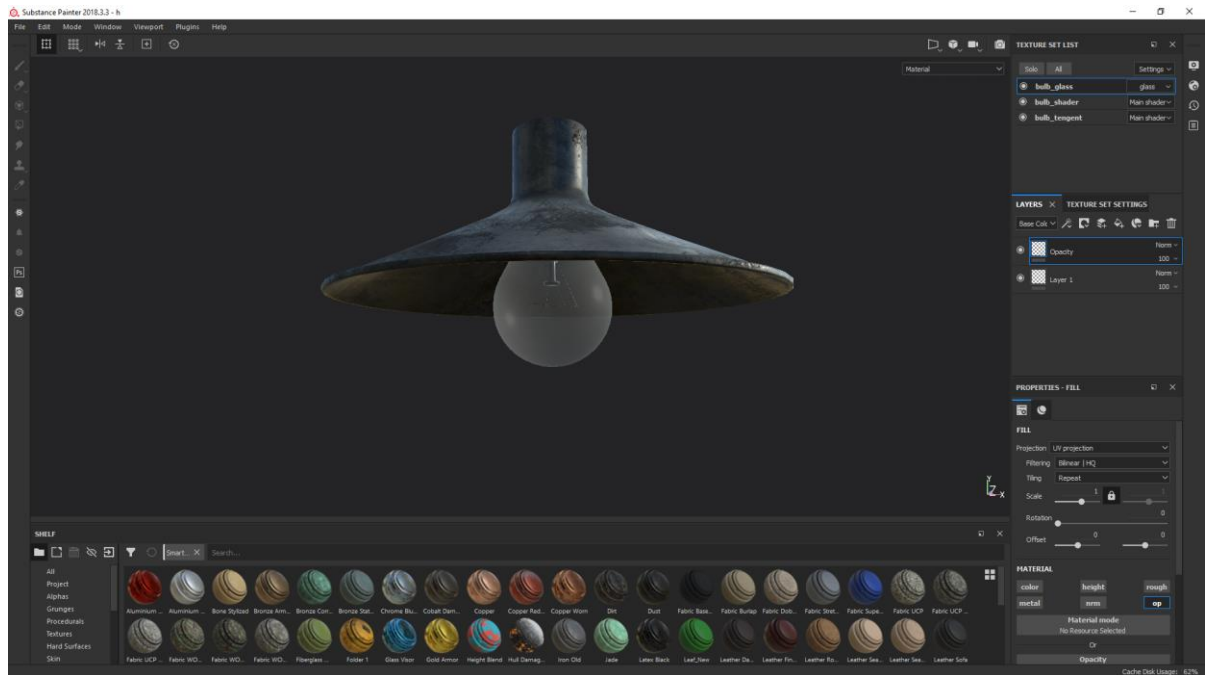


Figure 2.41 Hanging Bulb Texturing on Substance Painter

I completed the texture in similar process like another object. Import and export process are similar.

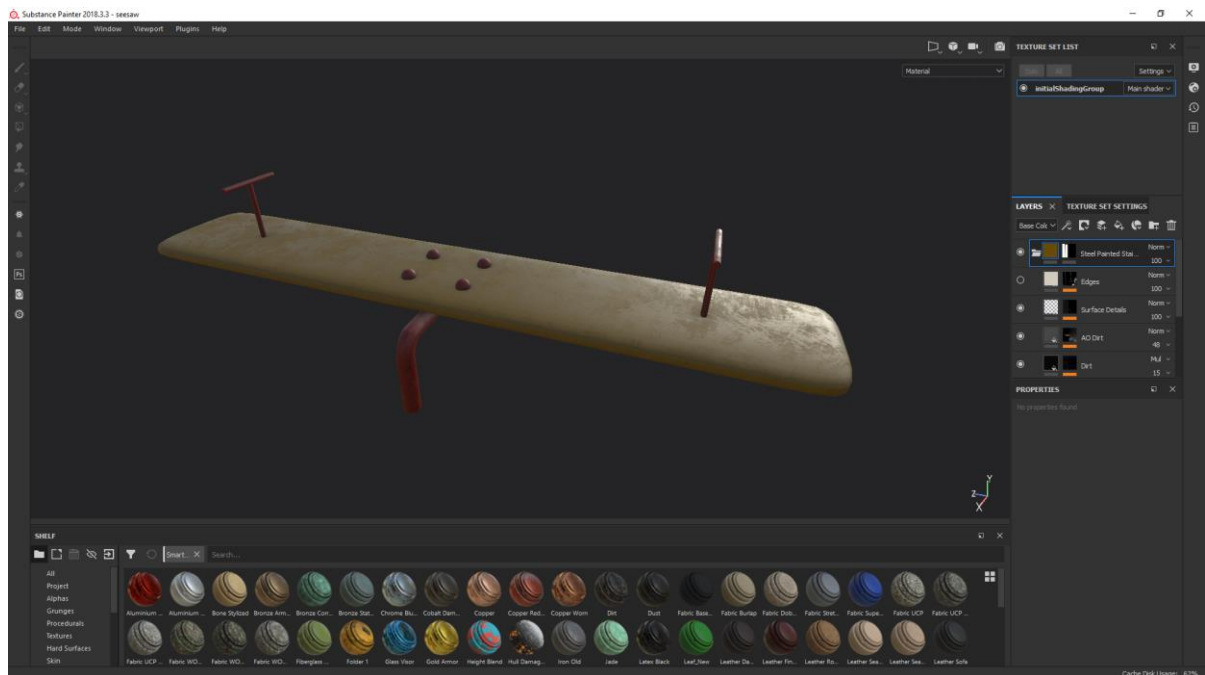


Figure 2.42 Seesaw Texturing on Substance Painter

2.3.9 Traveller tree:

After UV when the Traveller Tree ready for texture. I duplicated the generator Then subdivided the Traveller. The high poly traveller tree export as obj format I had to checked the UDMI tile options Then import the obj file from Substance Painter [4]. Then bake all texture. I used “Substances Share” [13] Default smart-material.

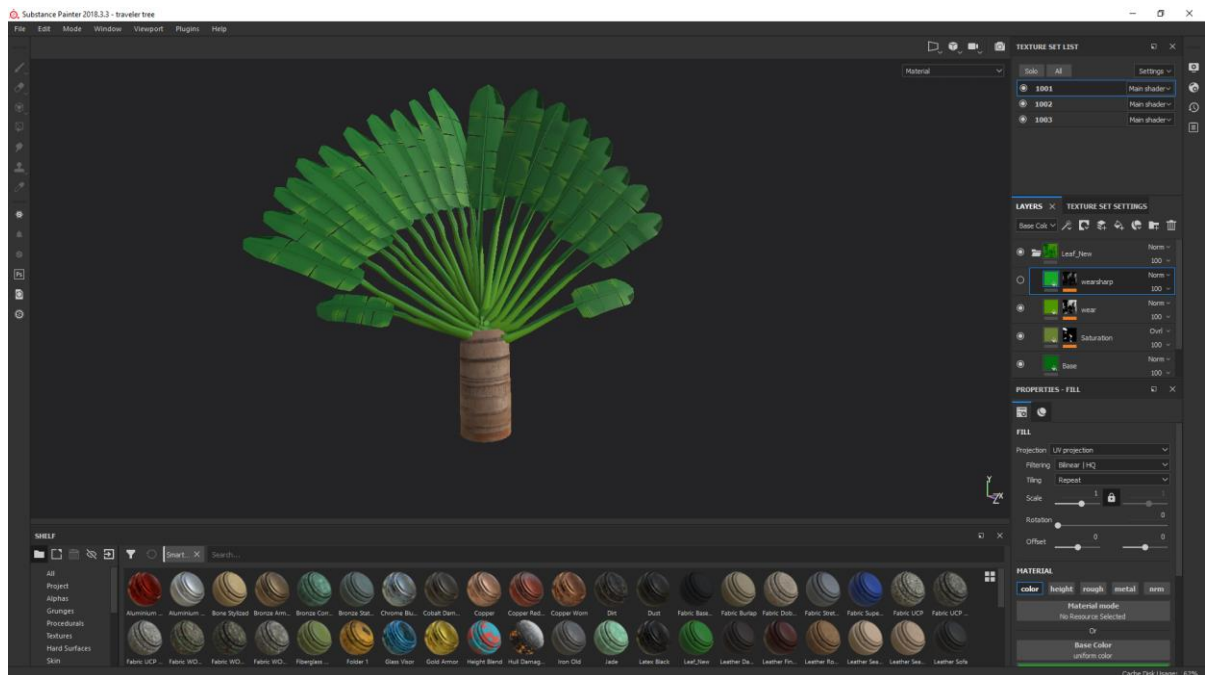


Figure 2.43 Traveller tree Texting on Substance Painter

Then Trunk texture Collected from “Texture.com” [11]. Import texture on current self. Apply the texture on the trunk. Increase the tiling of texture 1 To 4.7.

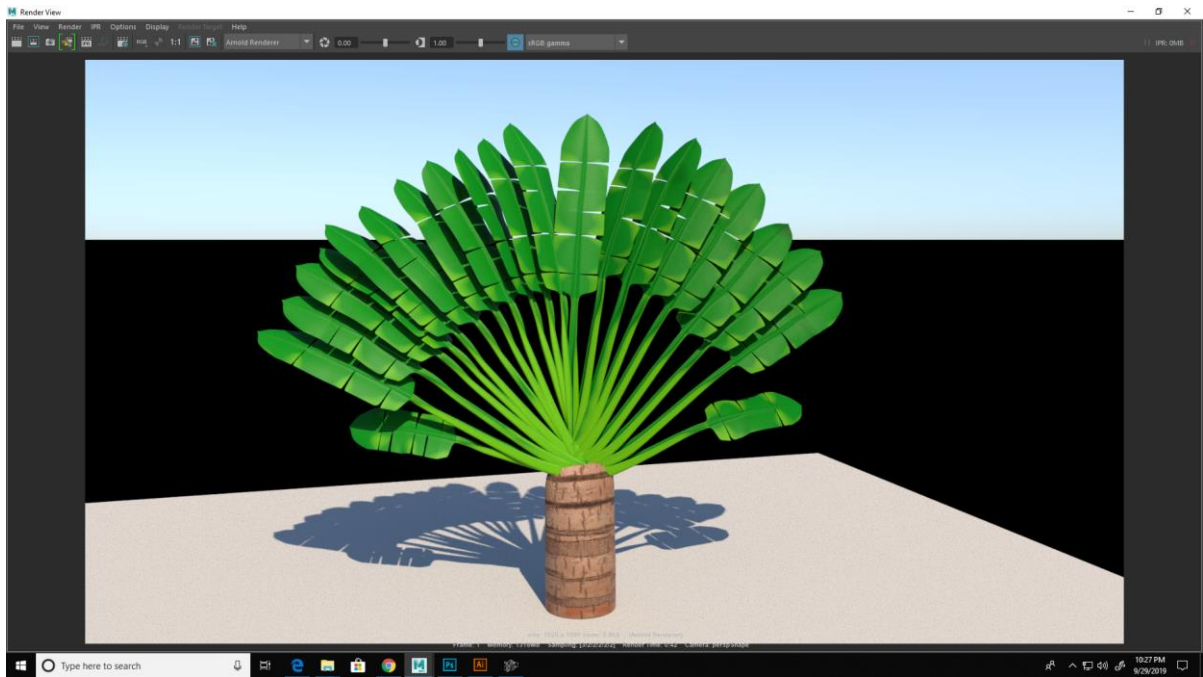


Figure 2.44 Traveller tree test render imager

Then export for “Autodesk Maya”^[8] for Arnold^[7] from (Self menu > file > Export Textures > Config > Arnold 5 AiStandard). Then set the location and Then export. Import the texture on “Autodesk Maya”^[8]. Import Base colour, Metalness, Roughness, Specular, and Bump on AiStandardSurface. There is a test render image is given bellow.

Trunk: The trunk collected from “Texture.com”^[11]. Then I create a normal map, And roughness map from Photoshop. Import texture on current self. Apply the texture on the trunk. Increase the tiling of texture 1 To 4.7. Then export for “Autodesk Maya”^[8] for Arnold^[7] from (Self menu > file > Export Textures > Config > Arnold 5 A standard). Then set the location and Then export. Import the texture on Maya. Import Base colour, Metalness, Roughness, Specular, and Bump on AiStandardSurface.

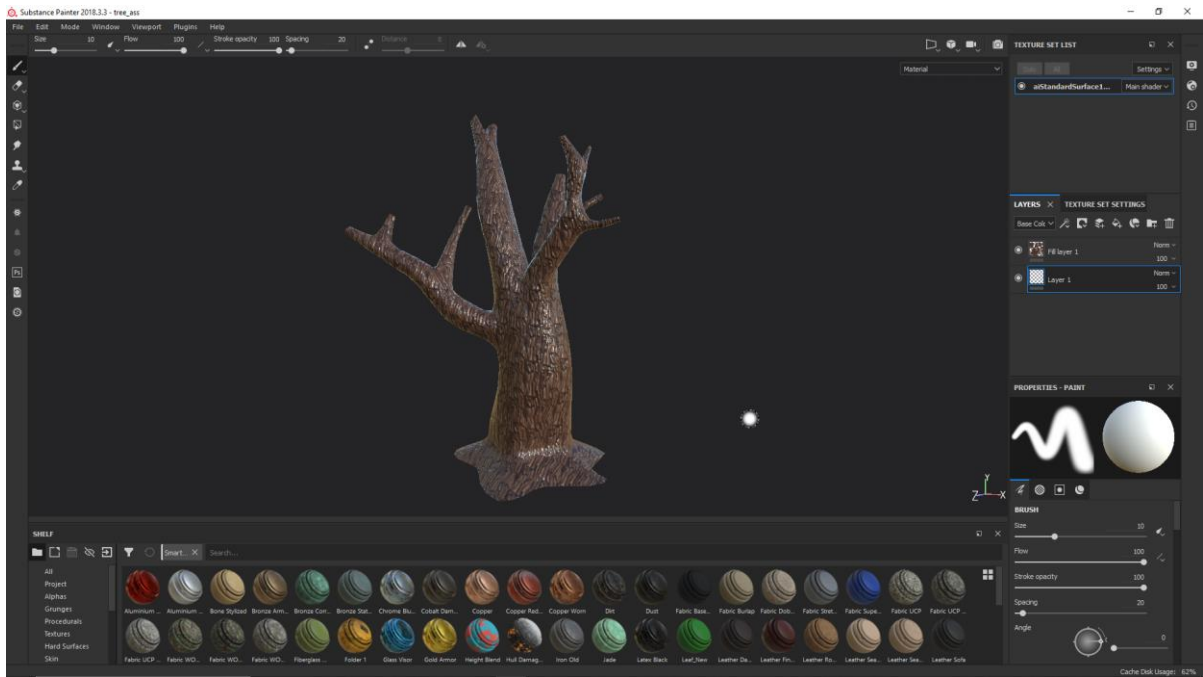


Figure 2.45 Tree Bark Texturing on Substance Painter

2.4 Mash:

MASH Is a Powerful tool on “Autodesk Maya”^[8]. By creating MASH network on any selected object can be waiter and distribute note can be added. It can on and object or any surface.

I used MASH for distribute leaves on the tree. I used plane for key leaf instead using leaf model for making in on low poly count. I collect the illustration of leaf from “freepik.com”^[1]. I made a Roughness map, and Alpha map.

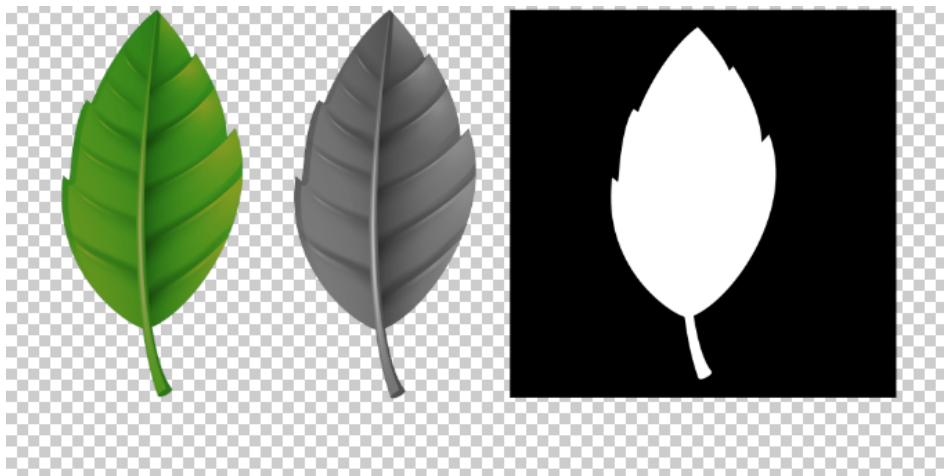


Figure 2.46 Tree leaf map

I use 3 types of png map for looking like a leaf. I plugged map 1 as a base colour map. Then the black and white one I plugged for Specular map, Roughness Map, Bump Map, Bump value > .01. And IOR value > 1.00. All Three types of leaf maps and value are the same.

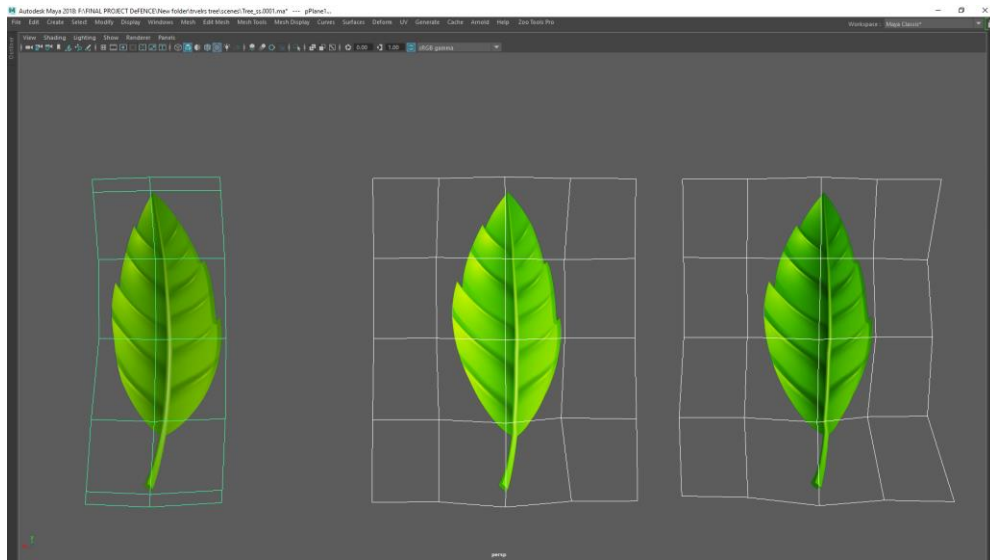


Figure 2.47 leaf map

Then I select one leaf then added MASH network. Then I go the MASH attribute > Distribution type > mesh > Input mesh I linked the proxy leaf which one is made of pSphere placed by Sculpt Geometric tools. Added 3 leaves for id map randomized 3.

A number of amounts use on different trees.

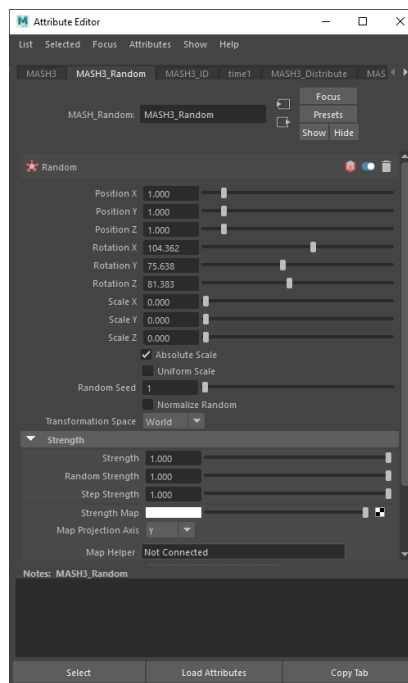


Figure 2.48 Tree leaf map

Using MASH network, I got this result and that's our stylized tree.

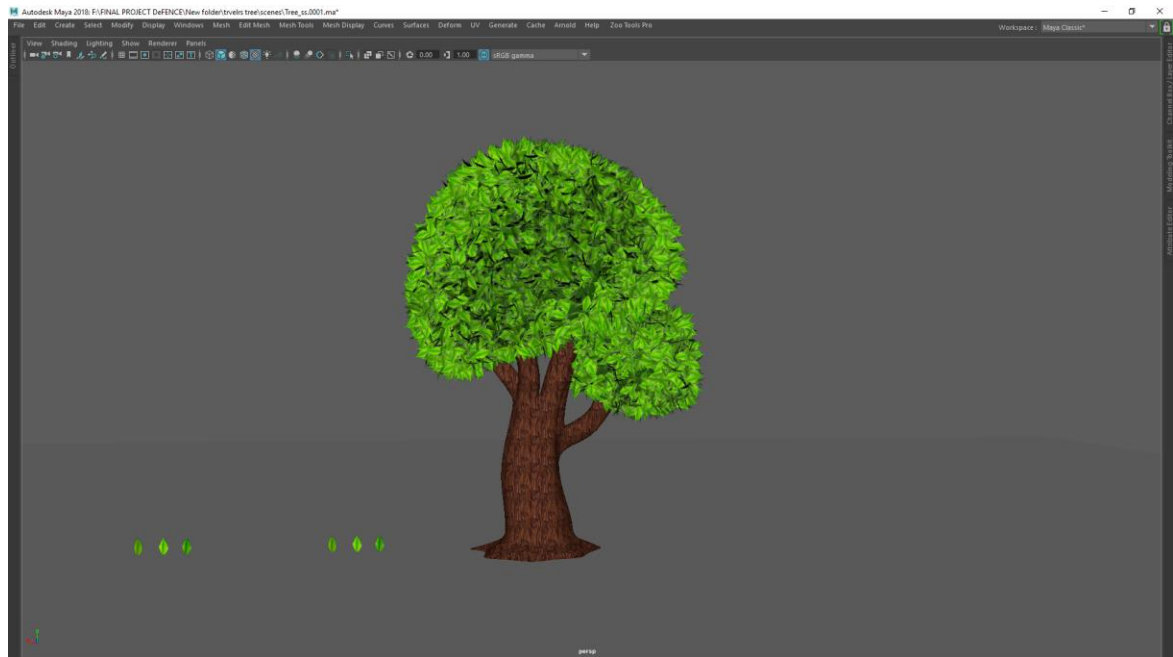


Figure 2.49 Stylized tree

2.5 Rigging:

Rigging was the most tedious part of this project. Rigging is the process of making a character ready for Animation. Setting up skeleton into the character body and bind the body with skeleton is the process of rigging.

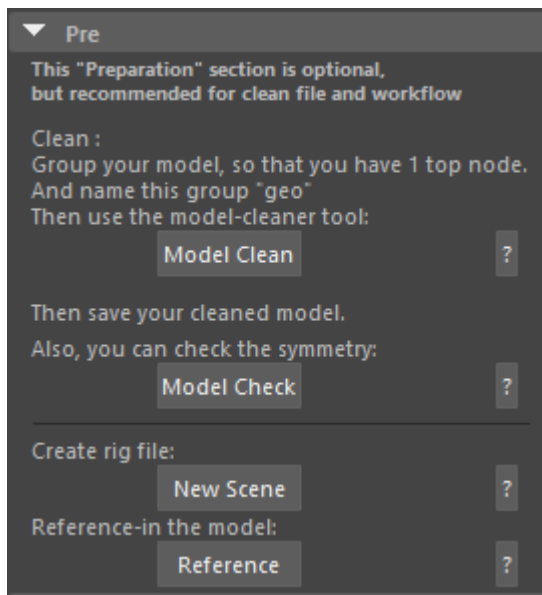


Figure 2.50 Character Rigging step

In This project we used a free “Autodesk Maya”^[8] plugin named “Advanced Skeleton”^[14]. Which is dedicated for rigging. Advanced Skeleton create rig not only for human character but also animals and props. 1st For rigging First clean the model and create geo for rigging. Its located-on Shelf > Advance Skeleton > Pre > Model Clean > Create > Clean. The model Should be symmetrical. I checked the symmetry of the character. The model was not symmetrical. Then I had to make this model symmetrical by deleting half of the face of the object from the middle.

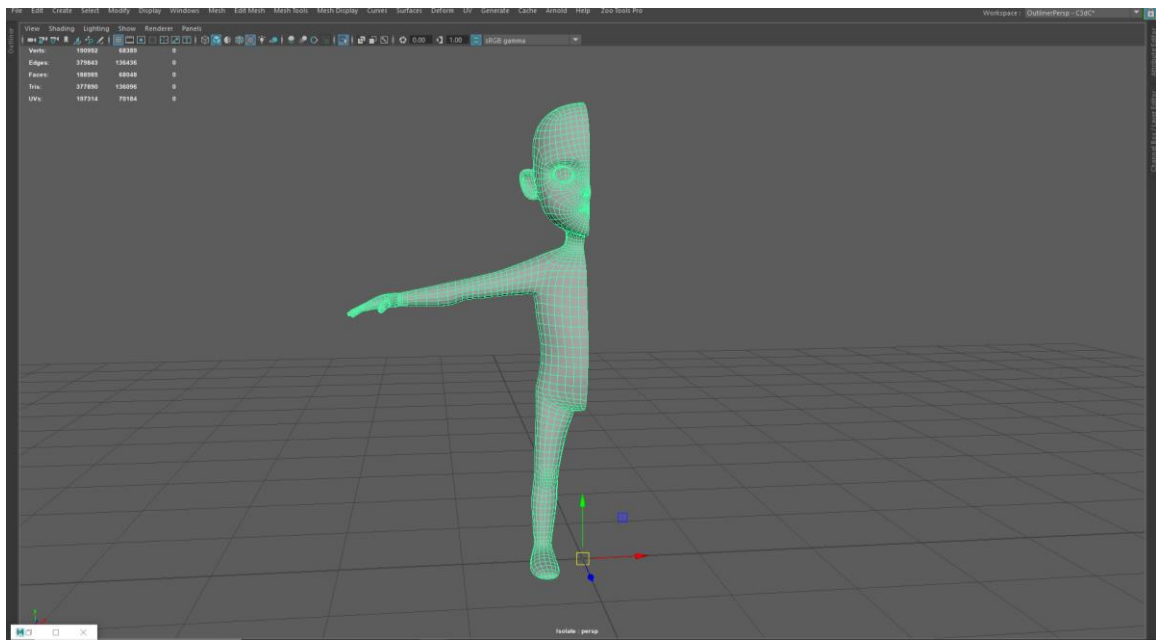


Figure 2.51 Character Rigging Symmetry

Then I Used Duplicate special tools. Its located-on Edit > Duplicate Special tools > Option box > Scale X axis value -1. Then I combine the 2 side of this character. And marge down the vertices of the character.

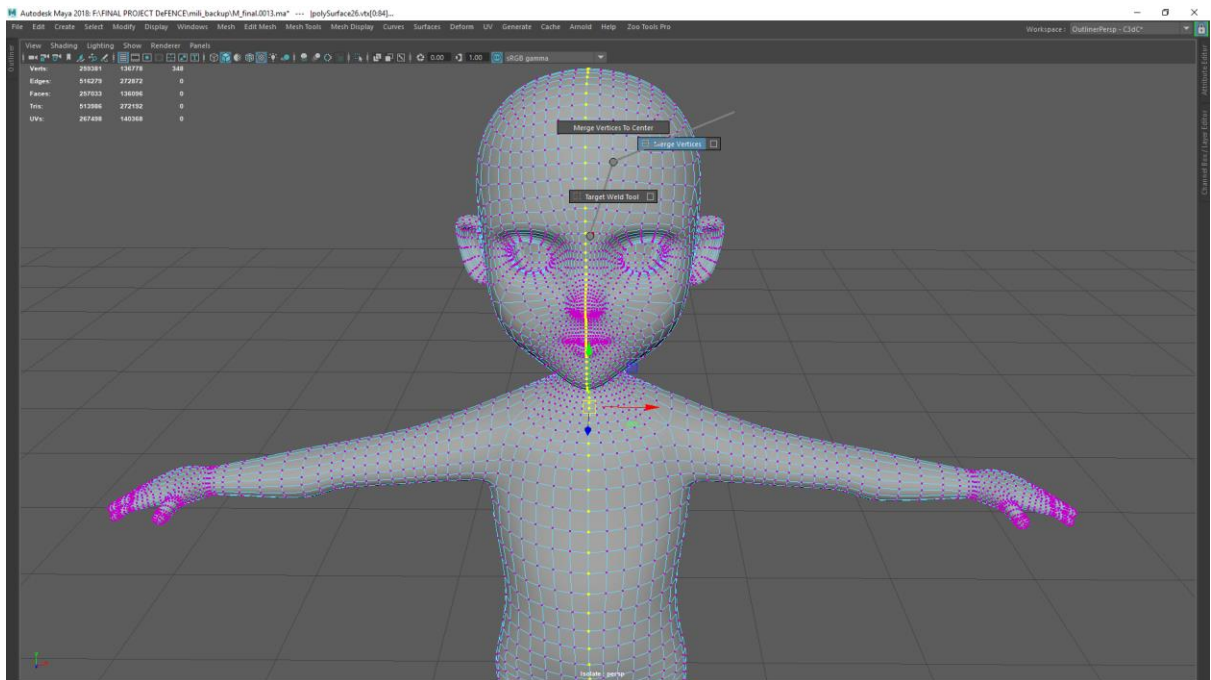


Figure 2.52 Marge character

After that I again checked the symmetry. The character was symmetrical.

2.5.1 Body Rigging:

Import biped from Advance Skeleton > Body > Fit > Import. Then I had to set the skeleton into the character in the correct order. Then I updated the Auto-Orient, Advance Skeleton > Body > Edit > update now. Then build the Skeleton from Advance Skeleton > Body > Build > Build Advance Skeleton. The skeleton was built.

3rd Step, Bind the body with Skeleton from select Body then Advance Skeleton > Body > Deform(option 1) > +Select Deform Joints > Set Smooth Bind Option. The bind Skin method I used in this project ,Bind to : Joint hierarchy, BindMethod : Geodesic : Voxel , Skinning Method : Dual Quaternion , Normalize weight : Interactive ,Weight Distribution : Distance and Max influences was 3.

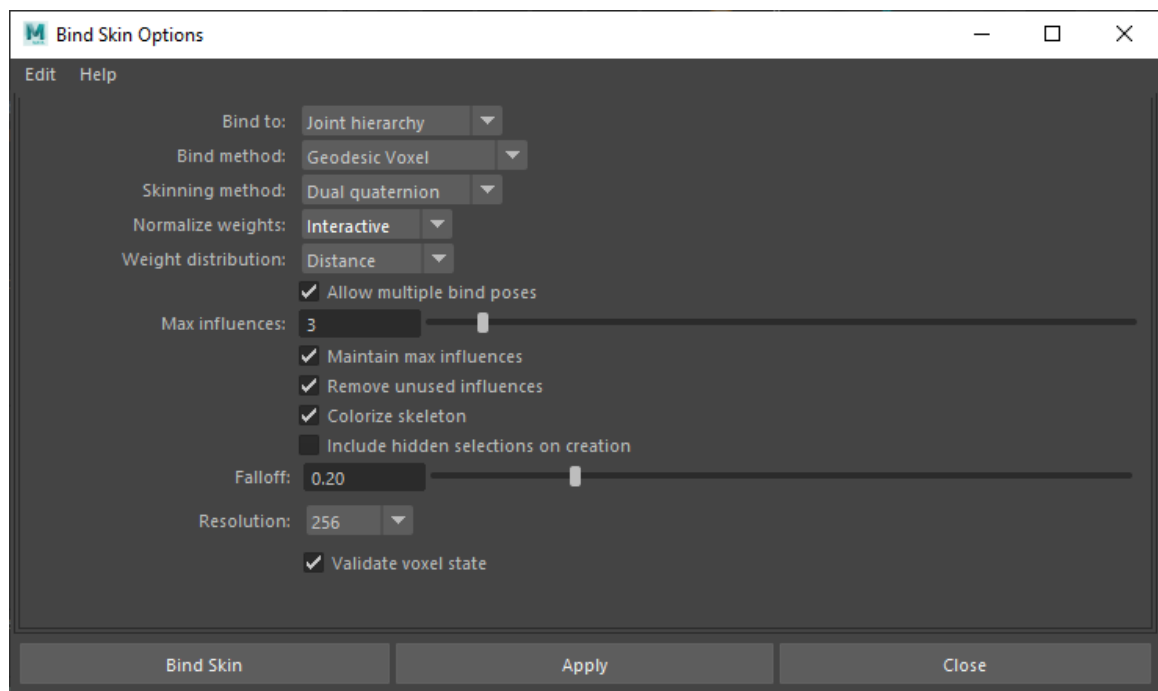


Figure 2.53 Character Binding Method

Face Rigging : For making facial expressions there are 2 popular methods .

1. Blend shape
2. Facial Rigging.

I used facial Rigging through Advance Skeleton. On Advance Skeleton in the face section the first i create Fit Skeleton Node. That create 2 Nurbs Circle.

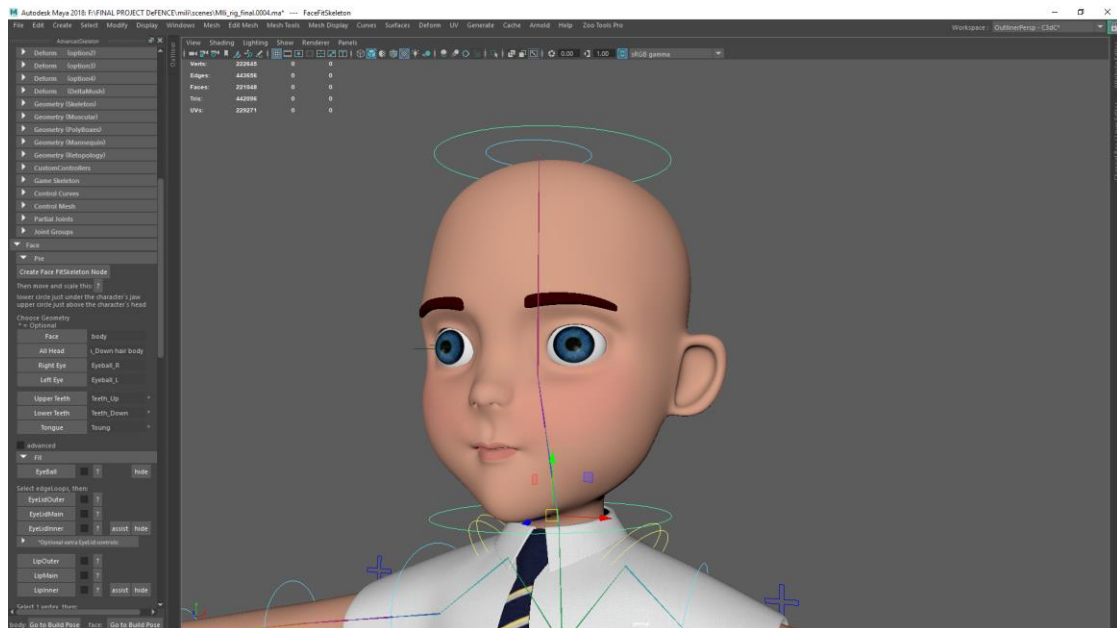


Figure 2.54 Character Rigging

I placed the Lower circle Just under the characters jaw and Upper circle just above the Characters head. Next step was to choose the geometry. In this section

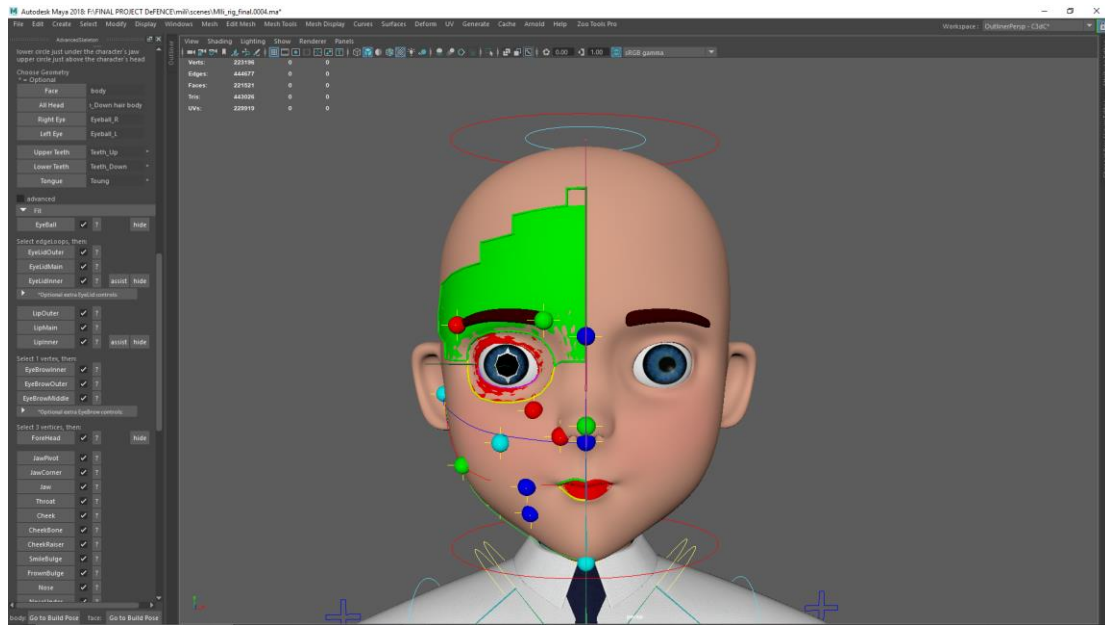


Figure 2.55 Character Rigging Face

Face : body, All head: Body, Eyeball. And the other requirements was Right eye ,Left eye, Upper Teeth , Lower Teeth And Tongue we drag and drop the information by clicking the middle mouse button. The next step was on fit. In There had Eyeball, EyeLidOuter, EyeLidMain, EyeLidInner, LipOuter, LipMain, LipInner, EyeBrowInner, EyeBrowOuter, EyeBrowMiddle, ForeHead, JawPivot, JawCorner, Jaw , Throat , Cheek , CheekBone ,CheekRaiser, SmileBulge, FrownBulge, Nose ,NoseUnder, NoseCorner, JawCarves. I had to go Through this options for facial rigging. Then I selected Automatic Build option. And apply DelatMesh On face For the default Skinning.

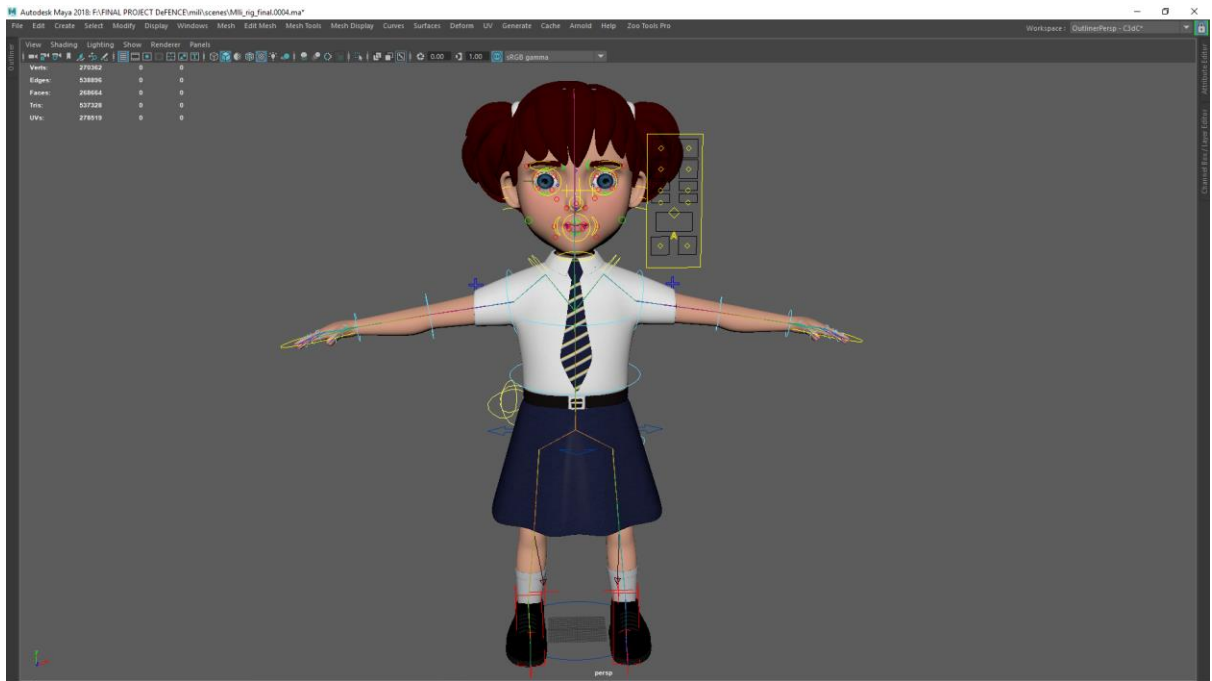


Figure: 2.56 Character Rigging face

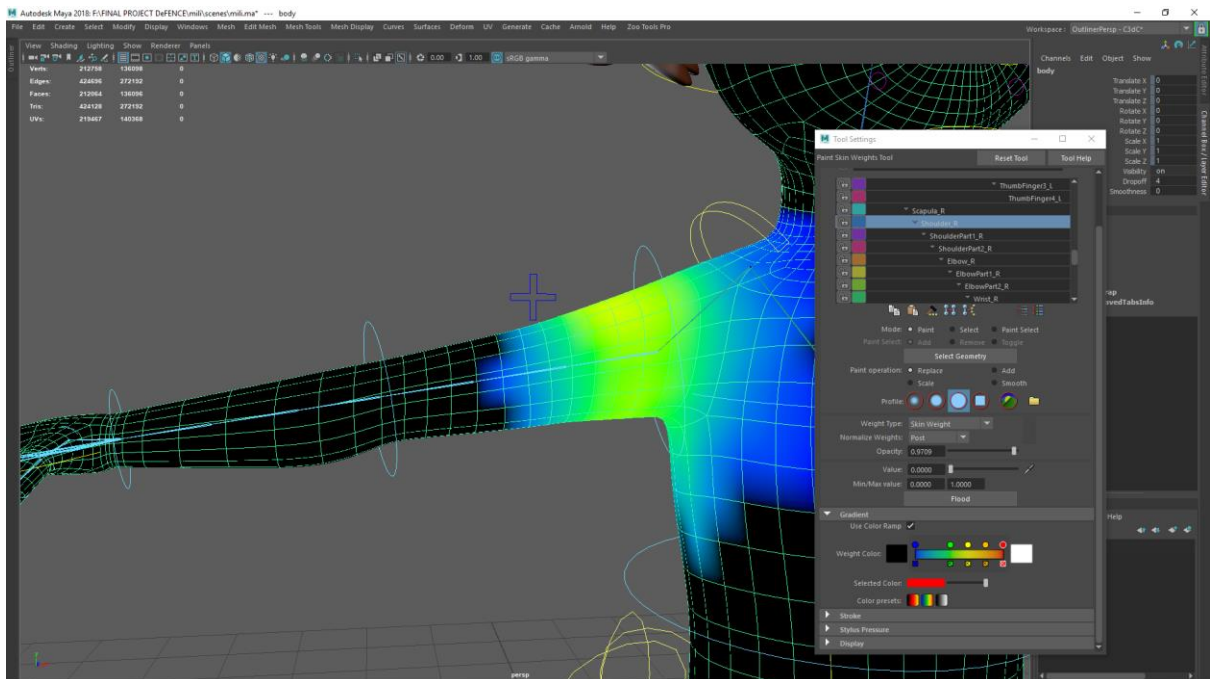


Figure: 2.57 Weight Paint

And The Last part of rigging was skin weight painting. The percentage of influence from different bones must be defined on the body that is called Skin weight painting.

I paint the right side of the character and then mirror the Skin Weight.

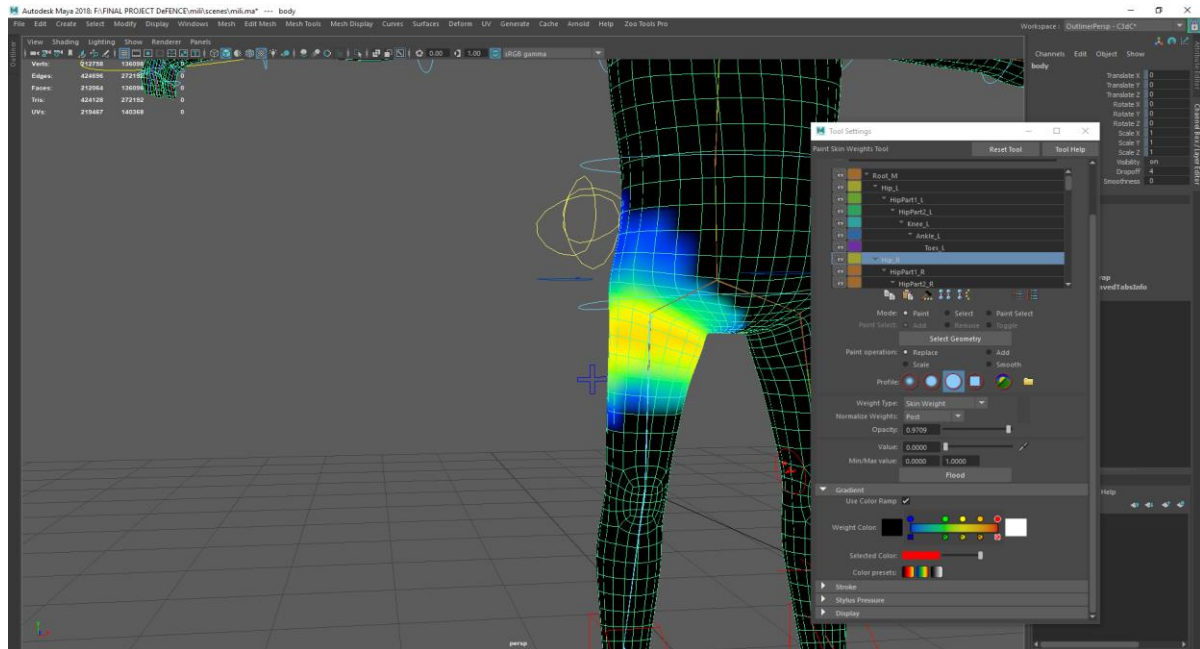


Figure: 2.58 Weight Paint

For the paint on character. I select the bone for adding influence or remove influence from the body. From weight Paint Tools.

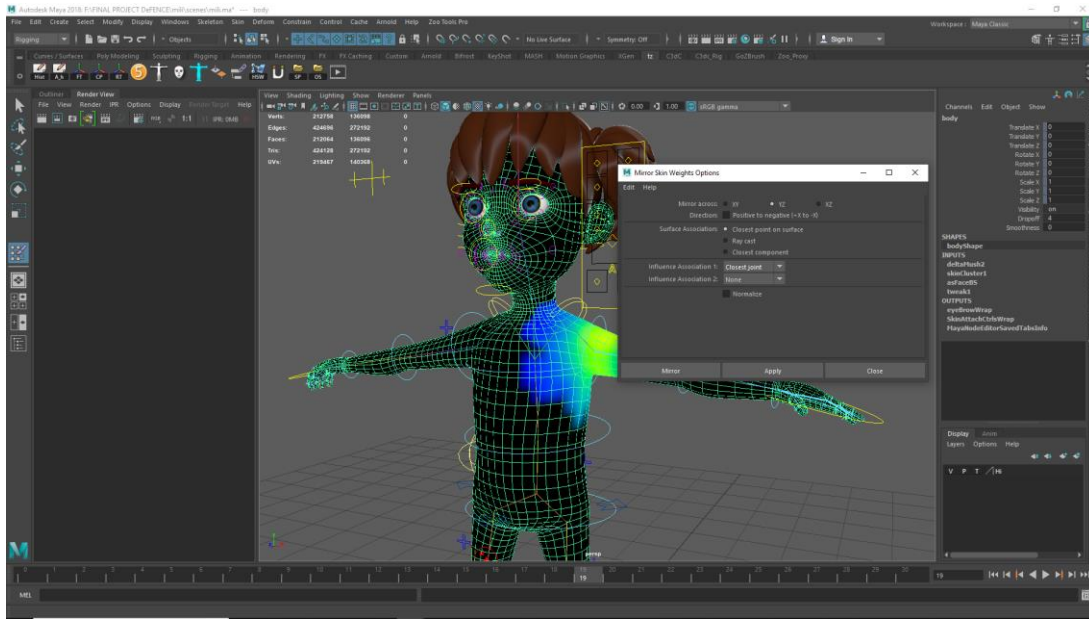


Figure: 2.59 Mirror Weight Paint

Then I bind the hair. That time I used same Binding method and paint max influence on it .

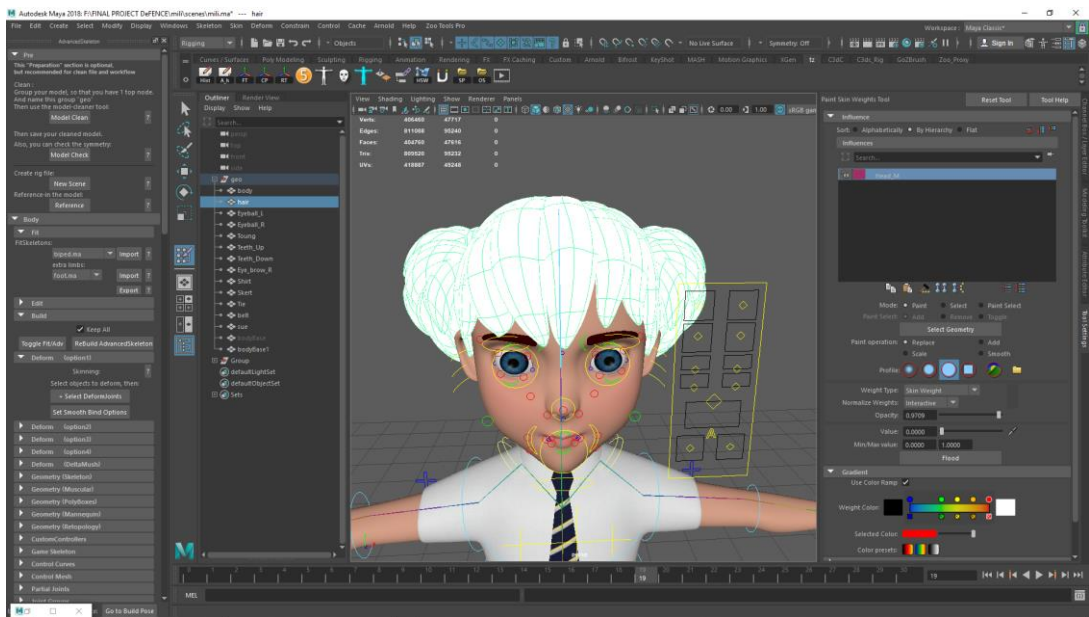


Figure: 2.60 Hair Weight Paint

Then I bind character cloths to the bone. And this time I changed the binding method closest distance Instead of Geodesic Voxel. Then I Copied screen weight from the character's body .

And paint right side of the characters clothes. Then Mirror the Skin weight. Then I checked the influence of the character cloths by moving characters body parts and it worked.

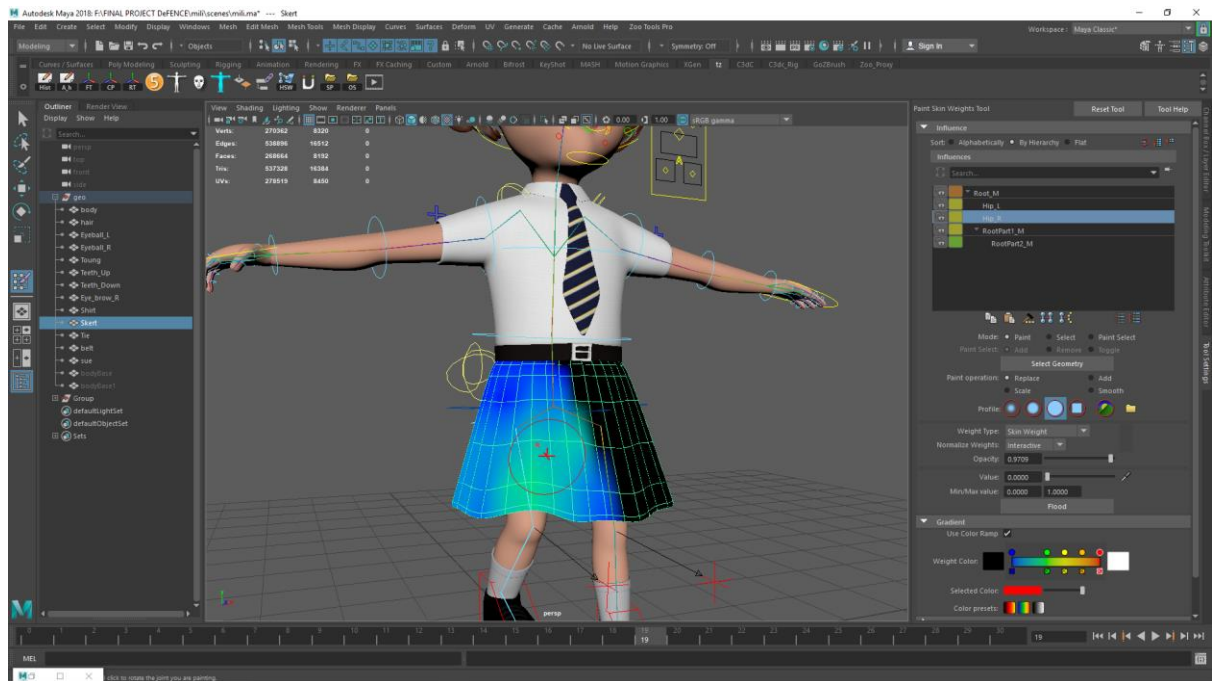


Figure: 2.61 Character Cloth weight paint

The rest of the character Rigged in the same way I have mentioned earlier .

2.6 Animation:

Before starting Animating the I have to checked the Weighted Tangent from (windows > Animation > Preference > weighted tangent) and Then Default in Tangent > Flat. Then Then Default out Tangent > stepped.

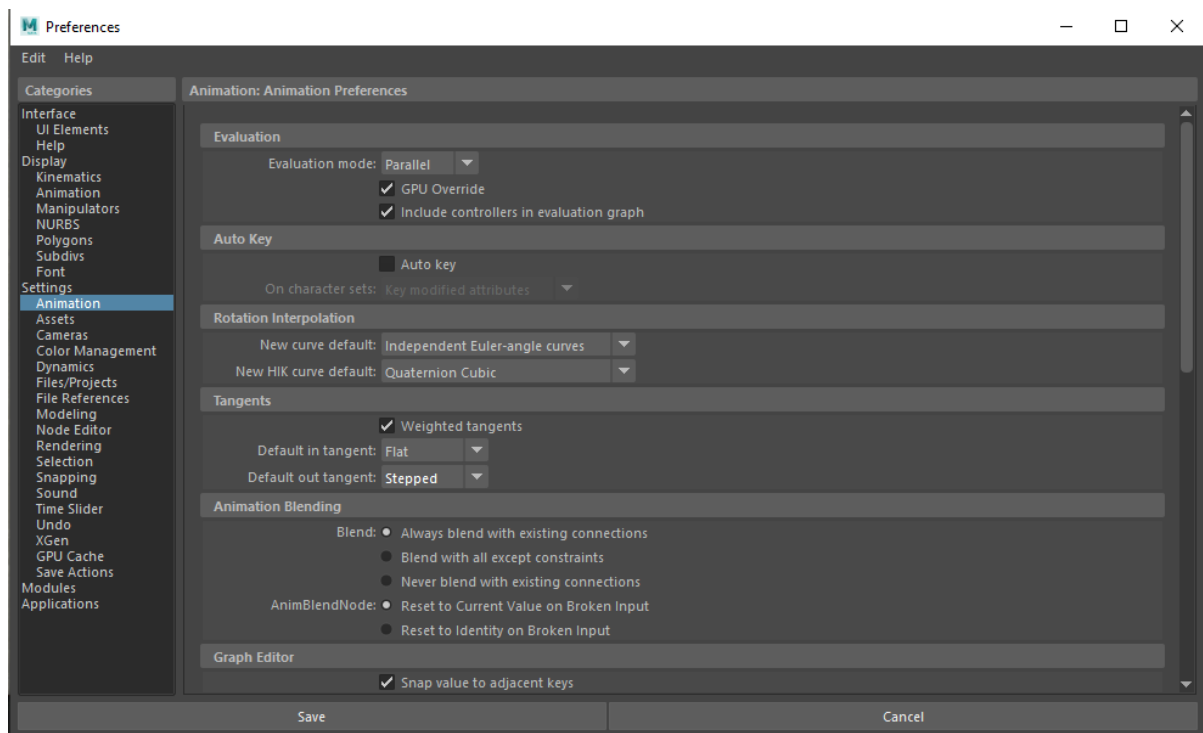


Figure: 2.61 Preference

It was a run cycle of our hero character Shanto. I collected the reference image of a run cycle. According the reference image I just copy the contact pose of a character And set key frame. It was 96 frame animation. First, I complete 1 run cycle in 24 frames. Then added one after run cycle by chopping contact pose

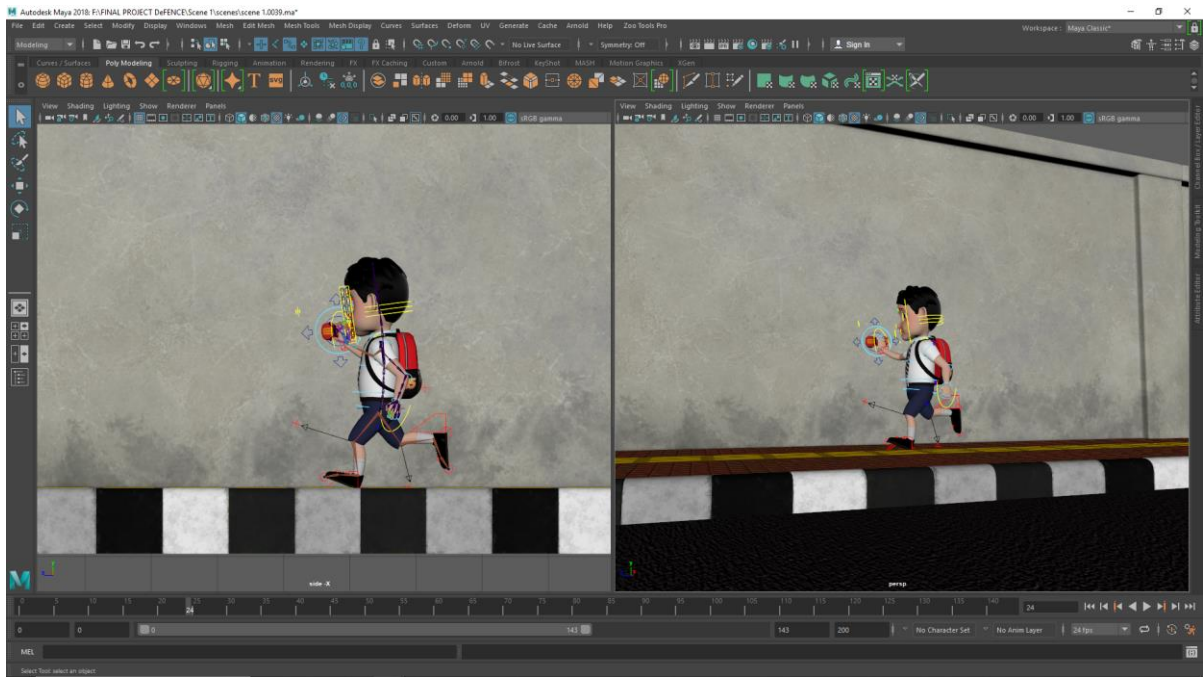


Figure: 2.62 Pose to pose animation

Select all the key Set the weighted tangent auto. By pressing D Or (Right Click + Tangent + Auto).

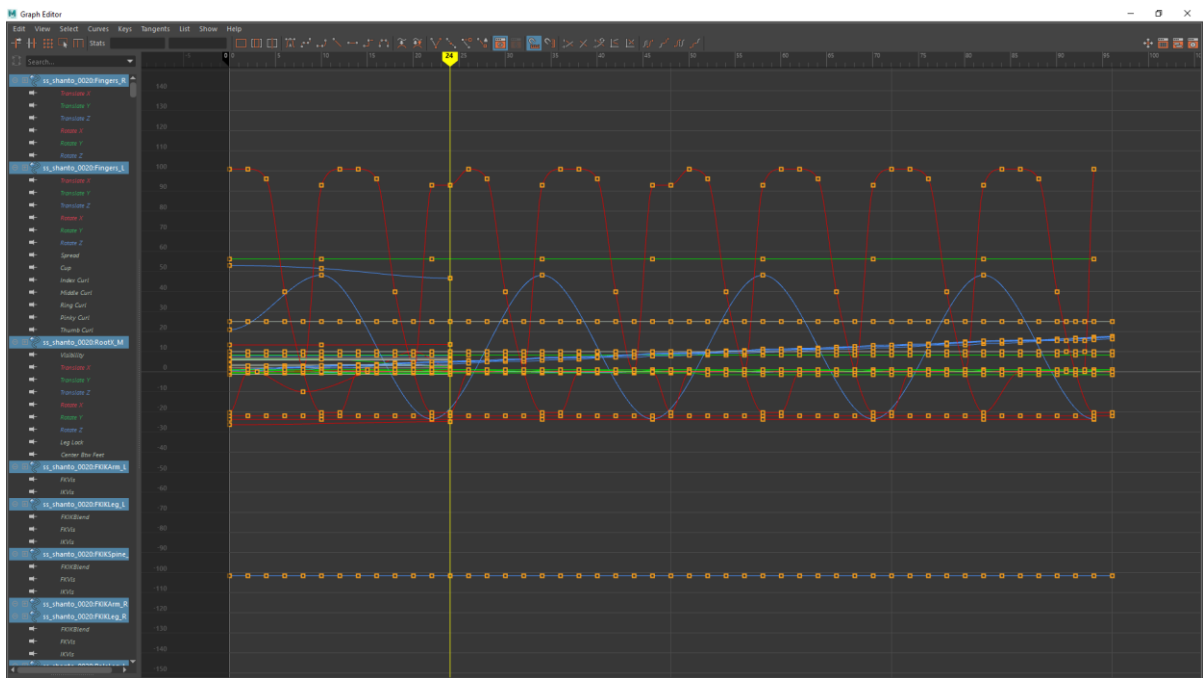


Figure: 2.63 Graph Editor

CHAPTER 3

Limitations and Challenges

3.1 Limitations:

A lot of intangible limitations were faced while working on this project. These limitations affected the output of our project in one way or another. Some of these are discussed below.

The most intangible limitation was the lack of experience. There were some experiences in all the steps in this process but the proper pipeline was never followed. Also, the scope of skill implementation was also limited. When it came to such a big project with a proper pipeline was to be followed, we fell short on experience we fell short on experience which affected time management and finding solutions to problems faced.

3D animation is a form of art which combines a lot of other forms of art. For initiating a project like this a lot of things from the artistic angle needs to be considered. Such as the colour palette of the film, the looks of the characters, forms of different models, postures sense, perspective sense, a sense of composition etc. For this reason, a strong hold on fine arts category is much needed. Unfortunately, this skill is inadequate. Being a student work there were no fixed budget for this project.

3.2 Challenges:

As this is a group project it was important that all the members work together with close proximity so that whenever any member faces a problem they can reach out to other members. This makes problem solving much easier and obtaining approval faster. Living in different homes at first there were no fixed spot where all four members could work together but eventually a room was rented and the challenge was met.

All the software used for 3D animation and rendering require high configuration computers. In this case the higher the configuration the better the quality. But for our average quality computers we faced a lot of challenges to work with. The software kept crashing or getting stuck. Sometimes they became slow and could not read the commands and execute them properly. Sometimes files would take several minutes to even open up. These kinds of problems wasted a lot of time which would not have been an issue if there were better quality computers available.

Computers with higher configuration can decrease render time exponentially. Render time a big factor when it comes to producing any computer graphics. Keeping computer limitation on mind sufficient time slot needed to be allocated for the rendering segment.

In order to create the desired outputs a few new software and commands from known software were needed to be learnt in a very short time. As the knowledge of these software were limited so problem solving became a big issue.

CHAPTER 4

Some Problems and Solutions

UV Unfolding: The default unfold option sometimes does not work properly while unfolding the shells. For eliminating this problem sometimes, the default unfold method needed to set to legacy in the options box beside unfold in the UV toolkit.

Rigging: as the project was done mainly in “Autodesk Maya”^[8] 2018.6, the plug in we were using for rigging did not work properly. The skeleton build process could not be completed. To solve this problem the rigging was done Maya 2017^[14].

Maya Mash: threes in this film were made with Maya Mash. While doing this sometimes the leaves were not attached to the surface of the mesh they were input on. They would scatter by offsetting around the mesh. It was then figured out that if the main leaf was freeze transformed at 0, 0, 0 point of the grid line then it would work properly.

Leaf Texturing: The leaves were made with a PNG file on a plane to make the trees low poly. But the leaves were not rendering transparent. By assigning maps in the parameters of the plane this problem was fixed.

Arnold Stand Ins: some heavy objects were made proxy by the Arnold Stand In options to the scenes would be less heavy. But these Stand Ins did not receive texture files when transferred to a different computer. Several methods were tried but the result was the same. We couldn't solve this problem entirely but it was decided the scene with Stand Ins will only be rendered with computer they were made in.

Source Image: while rendering the files were distributed to a number of computers. But some of the models did not receive textures directly from source image. So, they rendered without texture. This caused us system loss and a lot of rendered files were discarded. So, every file needed to be checked thoroughly before rendering in every single computer. This added to the total time allotted for rendering and created a time crunch.

Texture loading failed: as there were a lot of heavy models in most of the scenes and all of them had high resolution textures, the GPUs in our computer failed to load them eventually causing software crash sometimes. So, texture mode was turned off while working on heavy scenes.

Viewport loading failed: Some of the scenes were so heavy that the computers with lower amount of RAM failed to load them on the viewport. To temporarily fix this problem extra RAM was borrowed and added to the computers.

Storage problem: the entire project was approximately 1.5 TB in size. Some of the files also needed back up. To meet this challenge portable hard drives were managed.

Render time optimization: Each frame required 20 minutes to render on average. In this rate the total rendering time would exceed 2 months. We could not afford this much time so rendering was distributed to 29 Computers in total. This reduced render time exponentially leading us to finishing our project in time. Some of the scenes were also rendered in alpha channel where background could be a still image. This also reduce render time.

Manual Subdivision causes PC freeze: for giving a high poly look to the character hairs more subdivision was needed to be added. But by adding more subdivision the file size increasing a lot causing software crash. So instead of increasing subdivisions physically on the model, the iterations were increased in rendering within the Arnold tab which gave the model the desired high poly look without actually adding more subdivisions.

CHAPTER 5

Conclusion

Due to the weakness of the law and mass poverty, the number of child laborers are increasing day by day in our society. These children are subjected to harsh and dangerous working conditions, even in some cases physical abuse and sexual harassment.

This animated short film is a small attempt to expose all these inconsistencies of society with child labour.

While doing this project we had some unique experiences. We learned a lot of in-depth knowledge about 3D animation pipeline. This project gave us the opportunity to learn a few new software and more about the software's we were already familiar with.

We faced various issues while working on this project but solved most of them by consulting and researching together. Although there are some problems, we were unable to solve but we are keen to learn about them in the future.

REFERENCES

1. In a Heartbeat (Beth David and Esteban Bravo (June 1, 2017) , Retrieved June 15, 2019.
From "<https://www.youtube.com/watch?v=2REkk9SCRn0&t=156s>"
2. Piston (Hugo, Orso-manzonetta Vincent, Yang Kai) (Nov 16, 2018) Retrieved June 15, 2019.
From "<https://www.youtube.com/watch?v=KziJRVUHsoQ>"
3. Mr. Indifferent(Aryasb Fei)Nov 19, 2018 , Retrieved May 5, 2019.
From "<https://www.youtube.com/watch?v=qLGNj-xrgvY>"
- 4. Coin Operated (Written & Directed by Nicholas Arioli) May 22, 2019 , Retrieved May 5, 2019.**
From "<https://www.youtube.com/watch?v=5L4DQfVlcdg&t=34s>"
5. Alike(Daniel Martínez Lara & Rafa Cano Méndez) July 5, 2015, Retrieved May 5, 2019.
From "<https://www.youtube.com/watch?v=kQjtK32mGJQ>"
6. Watermelon A Cautionary Tale(Kefei Li and Connie Qin) April 23, 2018, Retrieved May 5, 2019.
From "<https://www.youtube.com/watch?v=lTxn2BuqyzU>"
7. The Present(Institute of Animation, Visual Effects and Digital Postproduction at the Film Akademie Baden-Wuerttemberg in Ludwigsburg, Germany)Jan 17, 2018 , Retrieved May 6, 2019 .
8. Autodesk Maya Retrieved 4th July 2019
From "<https://www.autodesk.com/>"
9. Substance Painter Retrieved 18th August 2019.
From "<https://www.substance3d.com/products/substance-painter/>"
10. Adobe Photoshop Retrieved 28th June 2019
From "<https://www.adobe.com/products/photoshop.html>"
11. Texture.com retrieved 2nd November 2019
From "<https://www.textures.com/>"
12. Arnold Retrieved 17th November 2019
From "<https://www.arnoldrenderer.com/arnold/>"
13. Substance Share retrieved 12th November 2019

From “<https://share.substance3d.com/>”

14. Advanced skeleton retrieved 3rd August 2019

From “<https://www.animationstudios.com.au/advanced-skeleton>”