FINAL YEAR PROJECT REPORT

3D Stylization of Real Footage Using Animation Principles and Visual Effects

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

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DHAKA, BANGLADESH

AUGUST 2023

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APPROVAL

This Project titled **"3D Stylization of Real Footage Using Animation Principles and Visual Effects"**, submitted by Aqil Daiyan 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 19th August, 2023.
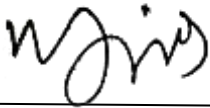
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DECLARATION

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

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ACKNOWLEDGEMENT

First, I express our heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete the final year project/internship successfully. I really grateful and wish our profound our indebtedness to Arif Ahmed, Associate Professor, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field 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 stage have made it possible to complete this project. I would like to express our heartiest gratitude to Md. Salah Uddin, Head**,** Department of CSE, for his kind help to finish my project and also to other faculty member and the staff of CSE department of Daffodil International University. I would like to thank my entire course mate in Daffodil International University, who took part in this discussion while completing the course work. Finally, I must acknowledge with due respect the constant support and patients of my family.

ABSTRACT

This project investigates the blending of real footage with animation principles and visual effects with 3D stylization in order to produce a visually appealing experience. The project demonstrates how a real video may be converted into a beautiful and stylistic story through computer generated imagery. The short film that accompanies this project, titled "Roofscape Runner," captures the spirit of parkour's energy while offering a unique cinematic style by employing animation principles and effects. The project shows the seamless integration of live-action video with 3D features, blurring the boundaries between truth and CGI. My project attempts to push the boundaries of traditional filmmaking and computer animation via use of software manipulation techniques.

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CHAPTER 1
INTRODUCTION

In an era intrigued by the mix of visual storytelling and dynamic athleticism, the value of an action and parkour-themed short film goes well beyond simply pleasure. This genre not only displays incredible acts of physical strength, but it also reflects the spirit of human resolve, pushing boundaries and conquering restrictions. The enthralling realm of 3D stylization interlaced with real-life film adds an enthralling layer to visual storytelling. This revolutionary method surpasses traditional bounds by injecting the whimsy and artistic flare of cartoons into the fabric of reality, giving rise to a distinct visual language that connects with audiences of all ages. This is why I have decided to create such a short film. It is titled 'Roofscape Runner' and it is a 3D stylized short film which incorporates elements of animation and real footage to create an unique short film. The title of this project is '3D Stylization of Real Footage using Animation Principles and Visual Effects.'

1.1 Summary of Visual Effects Compositing

Visual effects compositing is an important and sophisticated technique in cinema and digital media creation. It entails combining several visual components, which are frequently taken individually, into a smooth and coherent final image or sequence. This technology enables the construction of astoundingly realistic or imaginative situations that would be impractical or impossible to capture in-camera otherwise.

Combining live-action video with computer-generated imagery (CGI), integrating green screen or blue screen components, modifying lighting and color grading, creating realistic shadows and reflections, and much more are all part of visual effects compositing. The ultimate objective is to establish a harmonic integration of numerous aspects, resulting in a convincing and visually attractive final outcome. Compositors manipulate numerous visual components to bring a director's vision to life on screen, which necessitates a thorough grasp of both technical abilities and creative sensibilities.

The practice of mixing two or more pictures to create the illusion of a single image is known as

compositing. The composite process can be completed on-set, in-camera, or post-production. There are several techniques to combine images, but one of the most common is to place a weatherman in front of a greenscreen with weather information behind them.

Green screen capture, computer generated imagery, and rotoscoping are just a few of the advanced filmmaking techniques used in the composite process.

Compositing Techniques:
- CGI
- Matting
- Multiple Exposure
- Blue or Green Screen
- Physical Compositing
- Front or Rear Projection

1.2 History of Visual Effects Compositing

The History of Visual Effects Compositing is a journey distinguished by innovation, technological improvements, and the progression of artistic narrative. While the origins of compositing may be traced back to the early days of film, the genuine evolution of this art form began with the introduction of digital technology.

With the emergence of digital technology in the late twentieth century, visual effects compositing had a transformational moment. The arrival of computer-generated imagery (CGI) and digital compositing techniques transformed the industry. Films like "Star Wars" and "Tron" exhibited early kinds of digital effects, while "Jurassic Park" (1993) highlighted the possibilities of seamlessly blending live-action footage with computer-generated animals.

Background projection is simply the process of projecting the background information of a scene onto a screen (or plates) to create the illusion of a single image.

Background projection was employed in nearly every driving scene from the Golden Age of Hollywood; it wasn't ideal, but it did the job.

Matting was one of the more difficult early techniques. Matting is the technique of merging numerous parts of a film print, one at a time, onto a duplicate strip of film.

1.3 Compositing Real Footage with Green Screen

A green screen is one of the most useful tools that filmmakers can utilize in Post-Production to add visual effects compositing components. If you're not sure where to begin, read our post on how to make a green screen with DIY green screen hacks. Consider this: if you're integrating multiple photographs into one, then a green screen or blue screen is the ideal tool for stacking images to obtain that desired end result.

One must utilize a technique known as chroma keying to put a green screen to use.
Chroma keying is essentially the technique of removing a color from an image. For example, it is the process of removing green from a green screen video and replacing it with something else in Post-Production. However, as technology has evolved, some filmmakers have adopted a new method that eliminates the need for compositing.

1.4 Rotoscoping for Animation

One of the earliest sorts of composite images in film was compositing animation. Max Fleischer was an animated movie pioneer, and his notion to trace genuine footage irrevocably changed the course of animation.

Rotoscope animation is the method of tracing live action film frame by frame. By matting out items, a Rotoscope look can also be achieved in live action films.

Compositing is frequently used to create worlds that would otherwise be hard to produce in a realistic manner.

1.5 Glimpse of 2D Animation

2D animation is a delightful art style in which hand-drawn visuals bring characters and tales to life. When these images are displayed one after the other, they give the appearance of movement. It's similar to a flipbook, but on screen! 2D animation, with its colorful characters and backdrops, is a fascinating method to produce stories that grab our imagination and amuse audiences of all ages.

1.6 Glimpse of VFX

Visual effects, or VFX, are similar to movie magic in that they make objects appear genuine when they are not. They utilize clever computer tactics to generate amazing scenarios that would be too difficult or dangerous to capture in real life. VFX includes explosions, smoke and particles. It's how movies and television programs generate amazing moments that astonish and delight us!

1.7 Glimpse of 3D Animation

3D animation is a transformational technique that combines creativity and technology to create immersive and visually appealing worlds. Characters and landscapes are brought to life in astonishing three-dimensional realism thanks to precise digital sculpting and manipulation. Every movement and expression are sculpted, resulting in realism that captivates and fascinates viewers. Scenes are taken to new levels of authenticity and creativity with the use of physics simulations, lighting effects, and texture mapping. 3D animation combines creative vision with technological skill to create storylines that transcend traditional bounds and enable audiences to explore the

limitless horizons of creation.

1.8 Case Study Overview

This project seeks to investigate whether it is possible to create a film in which real-life footage is composited into a 3D environment and then exaggerated and stylized in the style of 3D animation using animation and visual effects principles, while maintaining the aesthetic of a short film without being uncanny.

This study also investigates the process of making a short film and the difficulties encountered. The 3D camera and surroundings are predicted to overcome the constraint of not having expensive film equipment such as camera dolly and camera crane utilized in large film productions.

The connected videos prompted me to embark on this study project and make the accompanying short film. My narrative concept did not occur to me in an instant, but rather developed over a lengthy period of time in my thoughts. I was captivated by how the connected films looked, how they made me feel, and, most importantly, how they were manufactured. I picked this assignment because I wanted to make something comparable to the linked works.

"Roofscape Runner" is a multidimensional short film that combines video production, motion graphics, 2D animation, 3D, matte painting, and visual effects. It is a video done with tremendous enthusiasm to demonstrate that it is feasible to create a short film that integrates real-life footage, animation techniques, and visual effects.

It is a short film about a woman who enjoys performing parkour acts on a crowded rooftop in a futuristic sci-fi metropolitan setting. It demonstrates that with unrestricted jogging like this comes a sense of freedom. Her audience, for whom she narrates her running adventures, senses this freedom.

1.9 Problem Identification

In the past many people have worked on similar story concepts as my subject that I am focusing my work on, however it seems to me that there are some aspects which can be highlighted as some problems. Some of them include

- The fact that although the policemen have been portrayed as villains in this work, policemen are not really the villains and they want good. Futuristic science fiction media often portray policemen as villains due to the dystopian setting of the stories.

- This film shows a child who has a disability of not being able to walk. This kind of disability in our society is seen negatively in our society. The protagonist in our story tries to help the child feel better by running in her stead.

- Free running can be dangerous. Parkour can lead to injuries such as broken bones which can affect a person for their whole life.

1.10 Objectives

The primary objective of this project is to create a good short film. The objective of the short film project is as follows:

- Discover the methodology of separating the frames of the footage in accordance to the principles of animation
- Discover the methodology of inserting a character from a real footage into a 3D environment by means of visual effects
- Implementing the principles of animation to create a short film.

CHAPTER 2
RELATED WORK

To understand what kind of task I was undertaking when I accepted working on this project and short film, I researched many films which implemented similar ideas to the ones I had. These are the main films that I had watched as research:

The Windshield Wiper, dir. Alberto Mielgo   Watch Dogs: Legion – Tipping Point, dir. Alberto Mielgo   Puss in Boots: The Last Wish, dir. Joel Crawford

Spider-Man: Into the Spider-Verse, dir. Peter Ramsey, Bob Persichetti, Rodney Rothman   Dynamo Dream: Salad Mug, dir. Ian Hubert   The Mask, dir. Charles Russell

Figure 2.1 The films that I researched

- The Windshield Wiper, dir. Alberto Mielgo[8]
- Watch Dogs: Legion – Tipping Point, dir. Alberto Mielgo[9]
- Puss in Boots: The Last Wish, dir. Joel Crawford[10]
- Spider-Man: Into the Spider-Verse, dir. Peter Ramsey, Bob Persichetti, Rodney Rothman[11]
- Dynamo Dream: Salad Mug, dir. Ian Hubert[12]
- The Mask, dir. Charles Russell[13]

All of the aforementioned films employed some form of stylization of cartoon effects which I am implementing in my short film.

CHAPTER 3
SCOPE OF THE PROJECT

3.1 Idea and Concept Generation

I was inspired by the related films to work on this research project and create the accompanying short film for it. The idea for this story of mine did not come in an instant but rather it formed over a very long period of time in my head. When I watched the related films, I was very fascinated by how they looked, how they made me feel and most of all how they were created. I aimed to create a project similar to the related works, which is why this project was chosen by me.

The setting of the story of my short film is in a futuristic densely populated urban area, which was inspired by many of the related works. The characters being able to run and parkour as well as the science fiction aesthetic of the looks were also inspired by the related work.

3.2 Scope of the Project

This project aims to study whether or not it is possible to create a film where the footage of real life is composited into a 3D environment and then exaggerated and stylized in the style of 3D animation using the principles of animation and visual effects, while maintaining the aesthetic of a short film without being uncanny.

This project also explores the methodology of creating such a short film and studies the challenges faced when creating it.

The 3D camera and environment are expected to circumvent the limitation of not owning expensive film equipment like camera dolly and camera crane which are used in big film productions.

CHAPTER 4
METHODOLOGY

4.1 Initial Concept of the Runner

The initial design had her having her hood on, wearing a pair of goggles, a red mask, and carrying a backpack.

Figure 4.1.1 Brainstorming the Runner character

I used a website called Hero Forge to help me visualize this character in 3D. Hero Forge is a website where people can create custom characters in 3D.

4.2 Comparison Between the Initial Concept Versus the Final Design

As is apparent from the following figures, the final design of the Runner had her hoodie kept off. There were cyan glowing highlights on her costume and all the red from her mask was removed. She is also not wearing any eye goggles.

Figure 4.2.1 Initial idea of the Runner

Figure 4.2.2 Final costume of the Runner

4.3 Policemen Concept

For the concept of the policemen, that is, what kind of uniform should they wear, how their attitude might be, etc, especially in this context where the setting is in a sci fi futuristic city, I looked up several reference images on the internet. After researching many images, I settled on having the policemen wear a type of raincoat and a British constable hat.

*Figure 4.3.1 Policemen
concepts*

4.4 City Concept

For the concept of the city, I did not have to go far, as the particular kind of aesthetic I was looking for was right here in my home city of Dhaka. I took many references of Dhaka city. However, in order to research about the sci fi elements of a futuristic city, I took many screenshots and found many images from various movies, video games and real life photographs.

Figure 4.4.1 Photograph of Dhaka city

Figure 4.4.2 Screenshots from the video game Hitman 3

Figure 4.4.3 Photograph of Kowloon walled city

4.5 Pre-Production and Project Overview

4.5.1 Pre-Production

For the pre-production, I studied the standard pipeline used in film industries. I created:

-Story draft

-Script

-Storyboard

-Character Design

-Costume Analysis

-Set analysis and props analysis

-Budget list

4.5.2 Story Draft

As the idea of the story of the short film came to my head, I had to note it down. I began with a draft written in an informal style which was faster for me to write.

The parts of the story where I had multiple ideas for the same event, I wrote both of them down separated by a "/" slash. After finishing the draft, I discussed it with my peers who are experienced in story writing and also my friends to get an idea of what sounds good to a general audience.

I listened to the feedback that I received from my peers and friends, and updated the draft accordingly. I added many aspects, and either removed or revised the aspects in the text with strikethrough on them.As is evident from the following draft, this story did not form overnight but was gradually accumulated from my mind to the paper. The parts of the draft that were scrapped are given in text with strikethrough.

I learned about script writing and story writing for film from the book Save the Cat! The Last Book on Screenwriting You'll Ever Need by Blake Snyder [1]

Draft: ~~*Bright noon*~~/*grim morning*/~~*lit night.*~~

We start on a rooftop. There are some pigeons. We hear running footsteps getting closer. We see close up of the footsteps. Title appears in a blur. The runner appears on the roof and jumps off the roof; the pigeons fly away.

She slides down/~~falls down~~ onto ~~the road~~/another rooftop.
~~Either~~ The city is ~~street level or city~~ on a roof similar to Chongqing.
She rolls and continues running with the momentum, parkouring past the obstacles and crowd.
There is an unfinished pro-freedom mural. ~~A/~~+police officer/s who were ~~standing~~/harassing a group of young mural artists.
As she runs she ~~passes~~/shoves through the police officers/snatches their equipment, they blow their whistles and chase her. The artists mock the police officers and cheer for her.

She runs and parkours over the city's obstacles. The police run after her knocking over everything and everyone. There is a florist along the way. She steals a flower that symbolizes freedom and pays him back by throwing a coin at him. The police chasing her knock/s down the entire flower stand.

She jumps across to another rooftop down where the police can't chase her. She sees them and mocks them. Out of breath, she drinks/splashes a flask of water. She then remembers her action camera and brings it up to pose like a selfie with the flower she had.

We zoom out to see her on a pair of monitors in a dark room lit by computers. There is a boy in a wheelchair wearing a VR headset who has been watching her. He grins seeing her with the flower.

4.5.3 Script

After finalizing the draft, it was time to properly transform it into a script in the correct screenplay script writing format. This was my first time writing a script in the industry standard proper format. The industry standard states that one page of the screenplay should show roughly one minute of the film, and since my short film is around 2 minutes long, I was able to achieve this in my screenplay writing with two pages of script. The script is written in the Courier New typeface which is the industry standard for screenplays scripts. I have also followed the rules of starting each scene with the shot location and whether it is external or internal, and the shot type, whether it is a close shot, a wide shot, or any other kind. Keeping with the standard of the industry, I have capitalized the names of all the characters for easy reading. [2]

Script:

EXT - TALLEST BUILDING'S ROOFTOP

A flock of pigeons are clucking about at the edge. Grim gray sky.
Faint running footsteps are heard. The cityscape is lower than
where we are.

QUICK CUTS:

-CU: RUNNER's feet from behind

-MS: Pigeons cluck about

-MCU: RUNNER's torso(neck to thighs), side view

-ECU: A pigeon looks at the camera in shock

-CU: RUNNER's feet on the edge of the roof as the pigeons fly away

LS: RUNNER jumps away in slow motion as the pigeons fly away.

The screen blurs and the title appears.

EXT - TALLEST BUILDING'S SLOPE

CU->LS: RUNNER slides down the slope of glass, then transitions
into a run on it before jumping off to:

EXT- CONNECTED ROOFTOPS

POV: RUNNER falls onto another rooftop and sprints away with the
momentum.

WS: RUNNER runs through the rooftop society

WS: RUNNER jumps down the rooftop through the spread legs of a man
holding up a sign

WS: RUNNER leaps onto another rooftop

Cut to the top of an unfinished mural on a wall. Pan down to show a pair/trio of POLICE OFFICERS in riot gear harassing a trio of MURAL ARTISTS. The MURAL ARTISTS are arguing back. There are paint cans and pain buckets.

RUNNER rushes past them, shoving a POLICE OFFICER into the ground. The POLICE OFFICERS give chase.

Cut to the RUNNER and the POLICE OFFICERS running towards the backwards moving camera.

Once again, there are obstacles that RUNNER parkours through with ease, while the POLICE OFFICERS tumble at them. Cuts follow:

-POV: We leap onto another rooftop.

-RUNNER cartwheels through a very narrow gap between two structures. The POLICE OFFICERS bump into each other when they try to run through it.

Still WS: There is a flower stand with a FLORIST holding arranging the flowers. RUNNER rushes past the stand, snatching the flower off his hand. As he yells at her, she flings a coin offscreen to his head. He accepts it just before the POLICE OFFICERS come and knock the entire flower stand over, leaving the FLORIST devastated.

EWS: Just as the POLICE OFFICERS are about to catch her, she leaps off the rooftop.

OTS: The POLICE OFFICERS can't chase her further.

EXT - FINAL ROOFTOP

RUNNER lands onto the lowest rooftop here. Out of breath, she looks back up and sees the POLICE OFFICERS cursing at her as they are forced to give up on her.
She takes off her headgear, takes a moment to catch her breath, produces a flask of water and splashes it on her face.

Then she remembers the action camera that was on her chest strap all along. She takes it out of the strap, poses it to herself and poses with her flower as she grins. We see the POV of the camera.

INT - DARK ROOM

We zoom out of the camera's POV to see the video being streamed to a pair of monitors. The room is very dark, lit by blue lights from the computers and the LED lights. In front of the computer desk, facing away from it, is the VIEWER BOY in a wheelchair wearing a VR headset. He grins in joy seeing RUNNER dedicate the flower to him.

Jump cut to the monitor to see the credits.

4.5.4 Storyboard

The storyboard was created digitally using the 2D animation software Adobe Animate, which allowed me to quickly draw the scenes in rapid succession. This storyboard format is an industry standard format used mainly for the purposes of animation. Since I have background experience in creating animation and my project short film is related to animation, I have decided on this kind of storyboard.

EXT - TALLEST BUILDING'S ROOFTOP

A flock of pigeons are clucking about at the edge.
Grim gray sky.
Faint running footsteps are heard.
The cityscape is lower than where we are.

QUICK CUTS:
-CU: RUNNER's feet from behind

-MS: Pigeons cluck about

-MCU: RUNNER's torso(neck to thighs), side view

-ECU: A pigeon looks at the camera in shock

-CU: RUNNER's feet on the edge of the roof as the pigeons fly away

LS: RUNNER jumps away in slow motion as the pigeons fly away.

The screen blurs and the title appears.

EXT - TALLEST BUILDING'S SLOPE
CU->LS: RUNNER slides down the slope of glass, then transitions into a run on it before jumping off to:

EXT- CONNECTED ROOFTOPS
POV: RUNNER falls onto another rooftop and sprints away with the momentum.

WS: RUNNER runs through the rooftop society

WS: RUNNER jumps down the rooftop through the spread legs of a man holding up a sign

WS: RUNNER leaps onto another rooftop

Cut to the top of an unfinished mural on a wall.

Figure 0.1 Page 1 of the storyboard

Pan down to show a pair/trio of POLICE OFFICERS in riot gear harassing a trio of MURAL ARTISTS.
The MURAL ARTISTS are arguing back.
There are paint cans and pain buckets.

RUNNER rushes past them, shoving a POLICE OFFICER into the ground.

The POLICE OFFICERS give chase.

Cut to the RUNNER and the POLICE OFFICERS running towards the backwards moving camera.

POV: We leap onto another rooftop.

-RUNNER cartwheels through a very narrow gap between two structures.

The POLICE OFFICERS bump into each other when they try to run through it.

Still WS: There is a flower stand with a FLORIST holding arranging the flowers.

RUNNER rushes past the stand, snatching the flower off his hand. As he yells at her, she flings a coin offscreen to his head.

He accepts it just before the POLICE OFFICERS come and knock the entire flower stand over, leaving the FLORIST devastated.

EWS: Just as the POLICE OFFICERS are about to catch her, she leaps off the rooftop.

OTS: The POLICE OFFICERS can't chase her further.
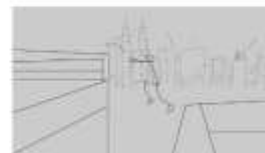
EXT - FINAL ROOFTOP

RUNNER lands onto the lowest rooftop here.

Out of breath, she looks back up and sees the POLICE OFFICERS cursing at her as they are forced to give up on her.

She takes off her headgear, takes a moment to catch her breath

She produces a flask of water and splashes it on her face.

Then she remembers the action camera that was on her chest strap all along. She takes it out of the strap, poses it to herself and poses with her flower as she grins.

We see the POV of the camera.

We zoom out of the camera's POV to see the video being streamed to a pair of monitors.
The room is very dark, lit by blue lights from the computers and the LED lights.
In front of the computer desk, facing away from it, is the VIEWER BOY in a wheelchair wearing a VR headset.
He grins in joy seeing RUNNER dedicate the flower to him.

Figure 4.5.4.2 Page 2 of the storyboard

4.5.5 Character Design

The story is focused on parkour and it takes place in the dense urban rooftops of a futuristic city, which is why the characters were designed to be athletic so that they are able to perform the necessary spectacular stunts.

4.5.6 Costume Analysis

As the story is set in a futuristic urban setting, I wanted my characters' costumes to reflect a futuristic cyber aesthetic.

Before the details of the costumes, the theme of the characters had to be set.

The Runner's theme was black and blue. I wanted the black to symbolize a stylish urban punk theme, and the blue to show her as the "good" character.

The Runner wears her hair tied up in a bun as it is practical for quick movement without hindrance. She wears a mask concealing her face to show that she is a rebel in this story, as rebels in real life often cover their faces. Her mask has glowing blue accents and metal decors to make it look futuristic.

Her top is a black hoodie with glowing blue accents. Hoodies are a common sign of rebellious urban youth.

Her bottoms is simple black trousers, comfortable and easy for running and jumping.

The shoes had to be manipulated with visual effects to give them their iconic black body and blue accents.

Black was chosen for easier visual effects manipulation, and the blue accents in the wrists, waist and feet gives us a clear silhouette of the character.

The Policemen's theme was black and red. The black here was used as the same way as with the Runner. The red was to portray them as the "bad" characters, as red is often depicted in cinema as the enemy.

The Policemen wear hats similar to the British constable hats for the iconic policeman look, marked by red accents and a red police crest on the front.

They wear a white shirt underneath their long black coats, with glowing red accents at the cape

and at the end. This long coat was chosen as a reference to the waterproof uniforms worn by detectives in movies and firemen.

Their bottoms, like the Runner's, is simple black trousers for easy running and jumping.

Once again, black was chosen for quicker visual effects manipulation, the red accents giving us a clear silhouette of the characters.

The Viewer Boy's theme was white, to portray a sense of innocence and neutrality. The room of the Viewer Boy lights him the same blue as the Runner, connecting the two characters to show the audience that they are on the same side.

4.5.7 Set and Props analysis

This is the list of virtual environment sets and props that were planned at pre-production. I created the assets that were in this list for my short film.

Scene	Environment	Props	Models
All	Sky HDRI		Runner
	Cityscape Background A		
	Cityscape Background B		
	Cityscape Background C		
EXT - TALLEST BUILDING'S ROOFTOP	Roof Railing	AC Unit Small	Pigeons
	Floor A	AC Unit Large	Pigeons Flying
EXT - TALLEST BUILDING'S SLOPE	Glass Slope		
EXT- CONNECTED ROOFTOPS	Background Building A	Bicycles	Static Character A
	Background Building B	Scaffolding	Static Character B
	Background Building C	Antennae	Static Character B
	Background Building D	Wires	
	Background Building E	Satellite Dishes	
	Puddles		
	Staircase with Railing		
Mural Scene	Mural Wall	Step Ladder	
		Mini Scaffolding	
		Paint Buckets	
Obstacle 03: Flower Stand		Flower Pots	
		Flowers	
		Flower Stand	
EXT - FINAL ROOFTOP			
INT - DARK ROOM			

Figure 4.5.7.1 The asset list

4.5.8 Budget list

This is the list of real life items that had to be managed for the film.

All prices are in Bangladeshi Taka (BDT)

Gear & Materials	Price	Costumes	Price	Props	Price	Upkeep	Price
Camera	0	Runner Tops	0	Chest Strap	0	Day 1	100
Interior Lights	0	Runner Facewear	0	Action Camera	0	Day 2	100
		Police Tops	0	Water Flask	0	Day 3	0
Software	880	VR Headset	0	Spray Paint Cans	0	Day 4	0
Green Screen	620					Day 5	100
Green Screen Holder	4080	Police Headgear	1200	Flower Pots	0	Day 6	100
Tripod	2400	Runner Ribbon	45	Flowers	250	Day 7	0
Clips	60	Runner Buttons × 10	50	Flower Stand	0		
		Elastic × 4 gauge	80	Wheelchair	0		
		Buckles × 4	80	Monitors	0		
		Red Tape	20				
TOTAL	8040	TOTAL	1475	TOTAL	250	TOTAL	400

GRAND TOTAL	10165
Extra: Camera	34700
Grand Total + Camera	44865

Figure 4.5.8.1 The budget list

I made several trips to the prominent market areas of Dhaka city such as New Market, Gausia, Chandni Chowk, etc., in order to assess the price of the items that I needed. I bought the items in the budget list from these markets.

As for the items in the list which show that the price is 0, I either created them myself or already had them in my house.

4.5.9 Asset Research

The city featured in my short film is run-down, which led me to a long hike all across the city to find suitable images of posters, banners, buildings and walls, which would be made into textures and then made into model assets for the scenery.

Figure 4.5.9.1 Photograph of wires to be used as reference

Figure 4.5.9.2 Photograph of walls to be used as assets

Figure 4.5.9.3 Photograph of posters to be used as assets

4.6 Production Overview

4.6.1 Production

I planned the production

I explained the scenes and the roles to the acting talents. I also made sure that the talents understood how their performance will be edited in post production, so that they are ready to perform.

The story takes place in a sunny noon, so the filming had to be done during the noon time.

I used a handycam to film. It has a built-in gimbal which was necessary to keep the filming steady, as a steady footage is crucial for visual effects editing.

4.6.2 Asset Creation

I collected various images from many different sources and used them to create a lot of assets for use in my shortfilm. I have also collected some of the assets from a website called Kitbash3D[3]

Figure 4.6.2.1 3D posters and walls created from photographs
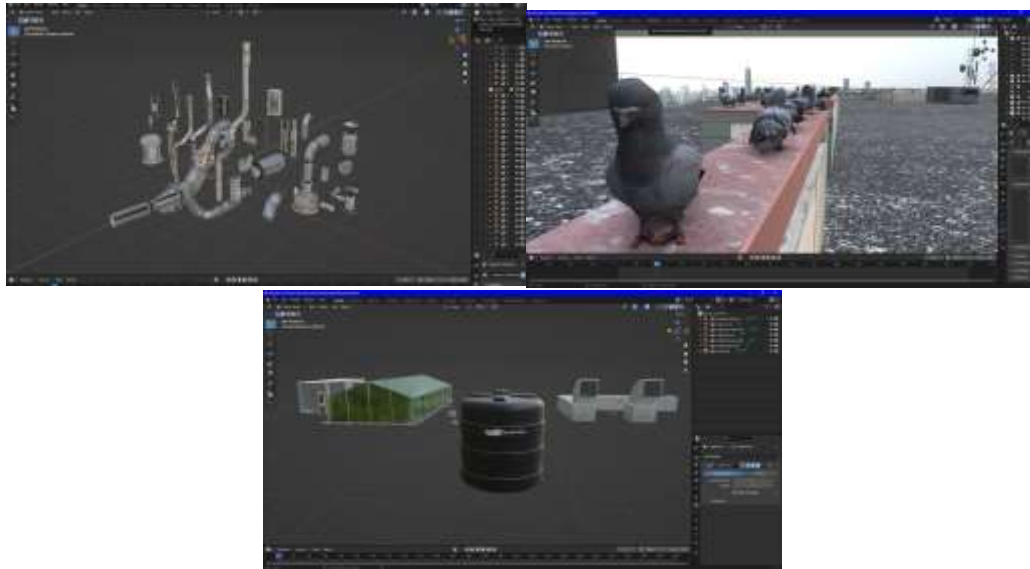
Figure 4.6.2.2 3D roof assets

4.6.3 Filming

Since this research-based shortfilm is highly stylized to look like 3D animation, I had to make sure my actors understood that. I taught my actors the twelve principles of animation and held many rehearsal sessions to get them accustomed to them and how to act them out in real life. I had to instruct my actors throughout the process of filming.

Filming of this short film was done at first using the camera of iPhone 13 and then later using a

handicam called DJI Pocket 2 which has an integrated gimbal which makes 3D tracking and rotoscoping easier.

Figure 4.6.3.1 Screenshot of real life footage

4.6.4 Exaggerated Movement in Acting

Since this short film is stylized to look like animation, I made sure that all the actors understood this. They were all instructed to exaggerate all of their movements like we see in cartoons. I taught them about this by explaining to them the principles of animation and showing them clips of cartoon animation.

Figure 4.6.4.1 Screenshot of exaggerated acting

Figure 4.6.4.2 Screenshots of exaggerated acting

4.6.5 3D Stunt Double

In recent years, film and television productions have begun to use computerized stunt doubles for specific action scenes. An almost-perfect clone of a character is created and inserted into a sequence, frequently to perform a superhuman feat that an actor, or even a well-trained stunt performer, could not accomplish.

There was one shot in the short film for which performing the necessary stunt was impossible for the actress. For that reason I had to model, rig, texture and animate a 3D stunt double.

In the industry, this process starts by scanning the model via a method known as photogrammetry. However, for my case, photogrammetry was not possible due to lack of equipment and experience, which is why I resorted to taking several reference photographs of my subject and created a digital lookalike using 3D software.

The model was then rigged using very simple forward kinematics bones. After it was ready, I animated it frame by frame using the animation principles that I have learned while taking reference from a real life footage of parkour stunt performers.
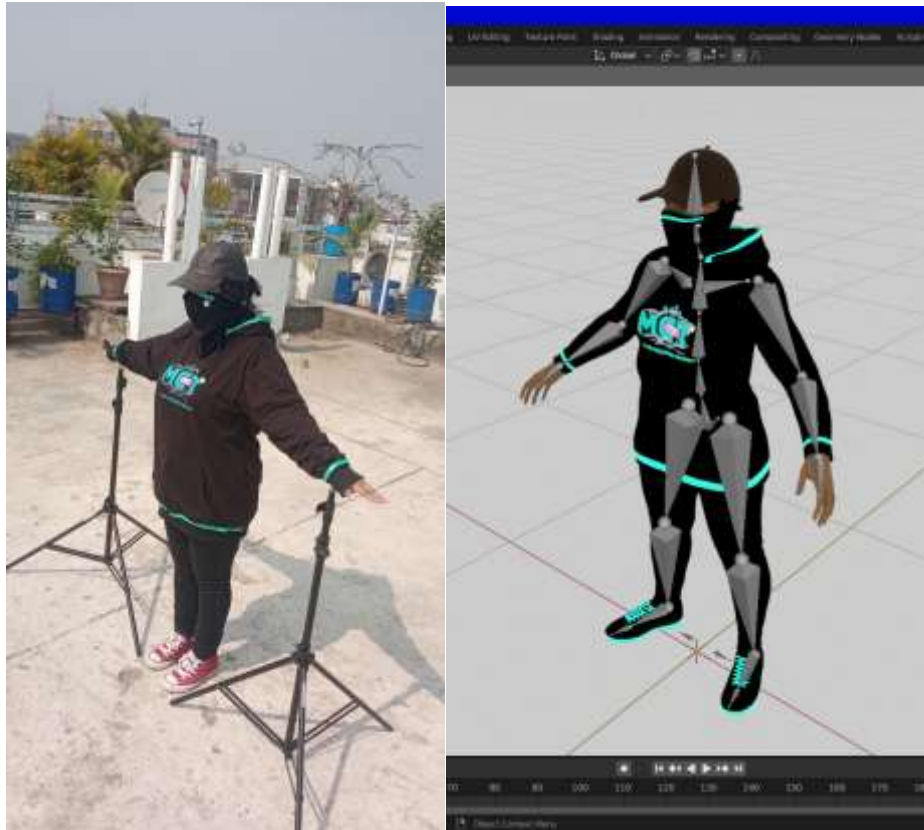
Figure 4.6.5.1 Creating 3D stunt double from real person

4.7 Post-Production

4.7.1 Frame Extraction

After obtaining the footage, I took the clips in the video editing software Adobe Premiere Pro. There, I trimmed the relevant sections of the clips. After that, I selected specific frames that I needed to create the stylized animation effect. The frames were not chosen automatically or by random, but rather following the animation principles shown in the following section.

To match the poses of the subject, references were taken from the book The Animator's Survival Kit by Richard Williams Expanded Edition [4] and Disney Animation-The Illusion of Life [5]

Figure 4.7.1.1 Extracting frames from real footage

4.7.2 Rotoscope and Alignment

Following the extraction of the frames of the clips, the next step was to mask the subjects out from their environment. This was done in two ways in two softwares.

For the parts where the masks had to be very detailed, I used Adobe Photoshop to mask out the subject frame by frame using separate layers for each frame.

For the parts where the masks did not have to be very detailed, I used Adobe After Effects. I used the Rotobrush 2 tool to mask out the subject, going through the clips frame by frame.


Figure 4.7.2.1 Aligning according to animation principles

4.7.3 Camera Matching

Camera matching, also known as camera calibration, is the technique of determining camera parameters from visual attributes. Based on user-defined control points in still photos, one computes the approximate focal length, orientation, and position of the camera in 3D space. The estimated camera settings can be used in other applications, such as 3D modeling software.

After obtaining the footage, the settings of the virtual camera in the 3D software had to be as close as possible to the real camera used to capture the footage. For this purpose, a software called FSpy was used.

Using FSpy, it is possible to compute the camera's orientation and position given two vanishing points and the position of the 3D origin. The distance between the camera and the 3D origin is set to a sensible fixed number by default. FSpy, on the other hand, can calculate this distance depending on the size of an object in the image using the vanishing point lines.[6]
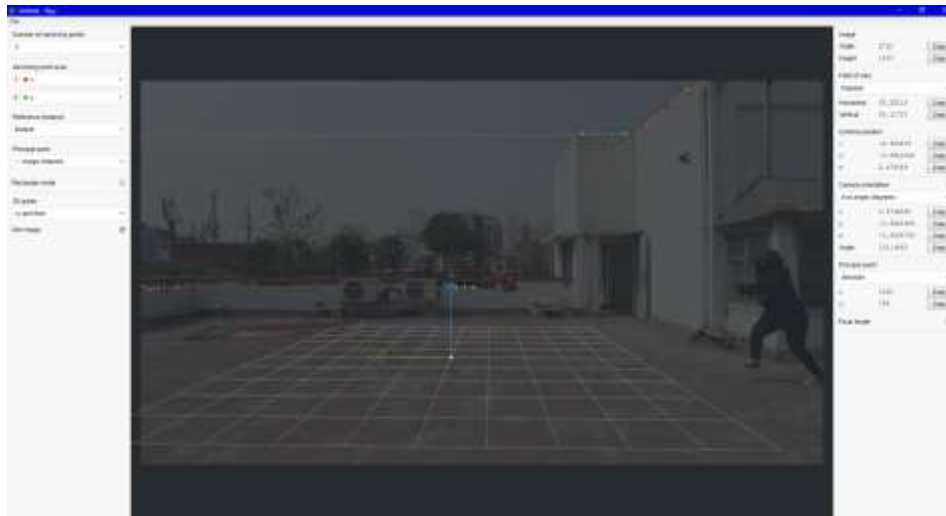
Figure 4.7.3.1 Creating 3D camera from real footage

4.7.4 Lighting Matching

The lighting in the virtual 3D environment has to match with the lighting conditions present in the

original footage, so that the shadows and highlights on the subjects make sense.

For this, I lit the virtual scene in two ways. First I linked a high dynamic range image(HDRI) to an environment texture that emitted light throughout the whole scene. Then I used a sun type light for the extra shadows and highlights. Sun type light in 3D softwares emits light parallelly without any light intensity drop-off from the inverse-square law, which allowed for easier light positioning.

Figure 4.7.4.0.1 Matching virtual lighting

4.7.5 Animation Using the 3D Stunt Double

After the 3D stunt double was modelled, textured and rigged, I used it in one scene to create a stunt which was otherwise impossible for the real actress to perform. It was a jumping scene from one building to another which would not have been possible.

First, I parented the rig to an empty. Then I animated the bones of the rig as well as the position of the empty so that the whole rig moves as was required.

Figure 4.7.5.0.1 Using animation principles with 3D character

4.7.6 Simulation

In order to animate the pigeons, I created a simple simulation. The basic of this particular simulation is that the pigeons are particles which are emitted from a particle emitter and follow a target. The pigeons do not have bones for their animation but instead are animated using shape keys.

The pigeon particles are created from the particle emitter and move towards the target in a random pattern, giving the illusion that the pigeons are randomly fluttering about.[7]

Figure 4.7.6.0.1 Pigeon simulation

4.8 Used Software

The main program that I have used for this project is Blender. This software allows me to model, texture and manipulate 3D objects, as well as add 2D cards that playback video and perform simulations.[15]

Adobe Premiere Pro has been my software of choice for picking out the appropriate frames of the filmed footage and for manipulating their speed and transformation parameters. On top of these, the software was used for color correction and final compositing.[16]

Adobe After Effects and Adobe Photoshop allowed me to rotoscope out the elements of the footage that I needed as well as add visual effects such as light glows.[17][18]
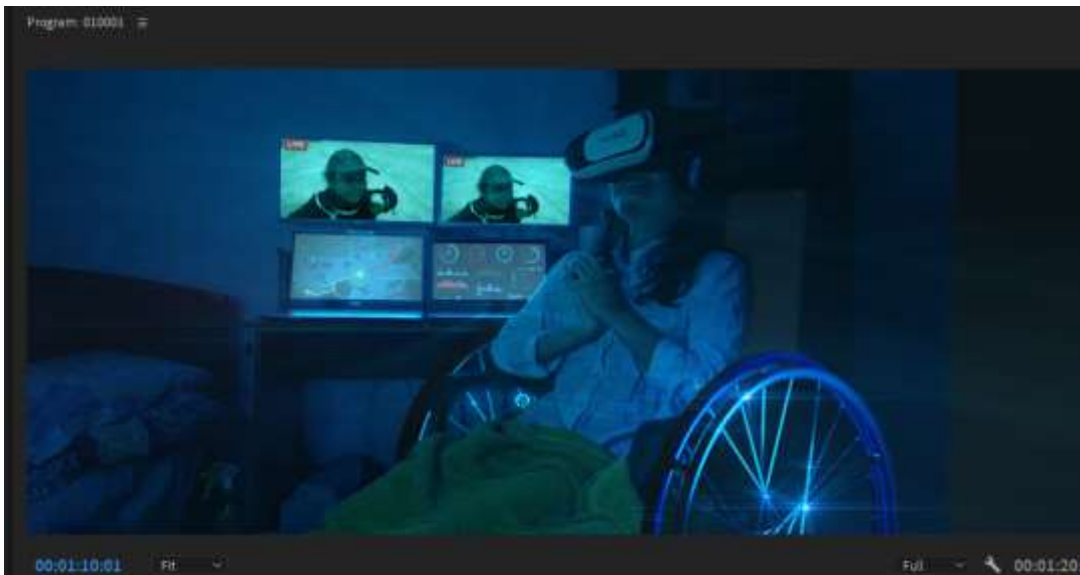
*Figure 4.8.1 Blender, After Effects and Premiere Pro*

4.9 Compositing and Editing

After all the animation was done, I used Adobe After Effects in order to create glows and lens flares.

I then used Adobe Premiere Pro in order to composite all the shots one after another as well as add color correction and elements and audio. I acquired the audio from the internet.

Figure 4.9.1 Use of glows and lens flare
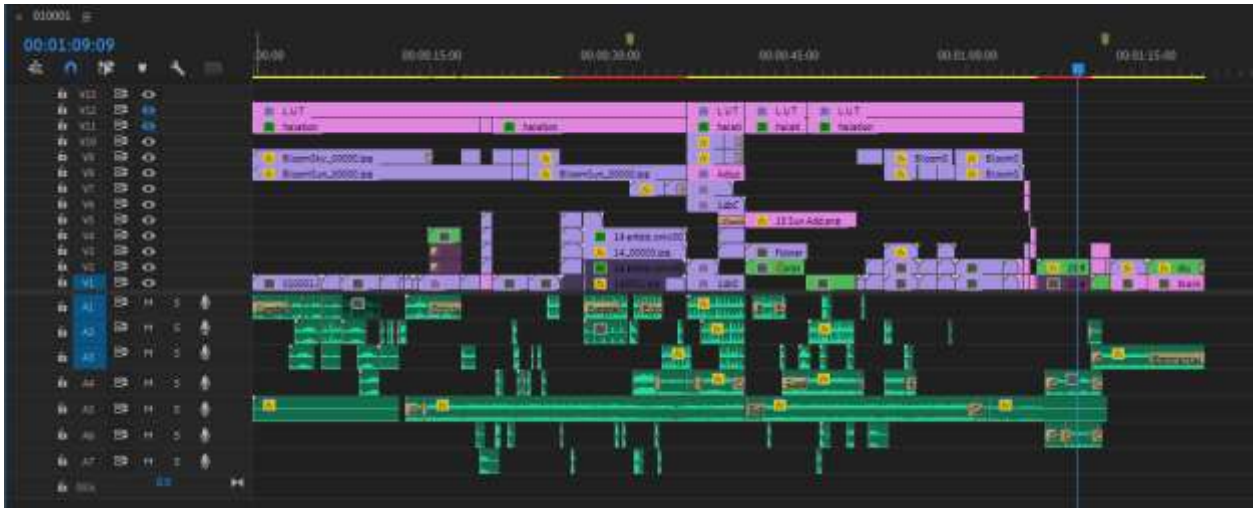
Figure 4.9.2 Compositing all clips and adding elements and audio

CHAPTER 5
ANALYSIS

5.1 Presentation of My Project

My final project is titled "**3D Stylization of Real Footage Using Animation Principles and Visual Effects**" submitted by Aqil Daiyan (ID: 193-40-634) Supervised by Arif Ahmed, Associate Professor, Department of Multimedia and Creative Technology, Daffodil International University. The title is accompanied by a short film, titled **Roofscape Runner**.

This short film was presented in front of a board of examining committee. A presentation slide was shown to explain the process and research of this film in summary.

5.2 Concept Versus Output

Comparison between the storyboard and the final output is given in the figures' respective captions.

Some scenes from the storyboard were omitted and some scenes were added in the final film.
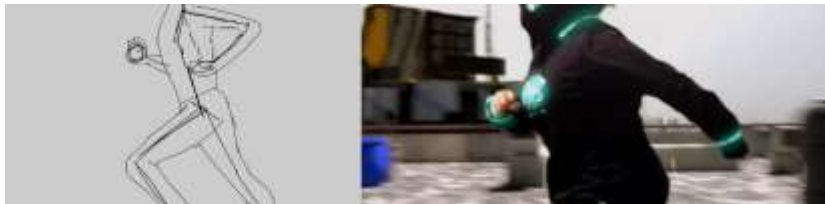

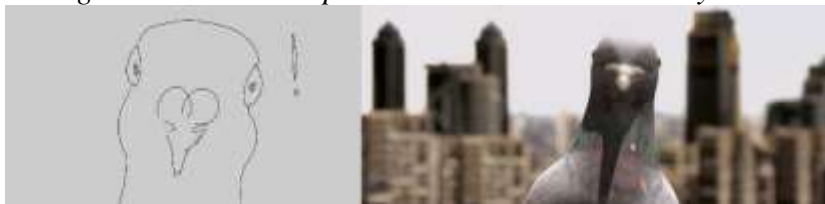*Figure 5.2.1: The output is consistent with the storyboard*

Figure 5.2.2: The output is consistent with the storyboard

Figure 5.2.3: The output is more wide angled than the storyboard

Figure 5.2.4: The output is consistent with the storyboard

Figure 5.2.5: The output is consistent with the storyboard

Figure 5.2.6: The output is consistent with the storyboard

Figure 5.2.7: The output is consistent with the storyboard

Figure 5.2.8: The output is consistent with the storyboard

Figure 5.2.9: The output is consistent with the storyboard

Figure 5.2.10: The output is consistent with the storyboard

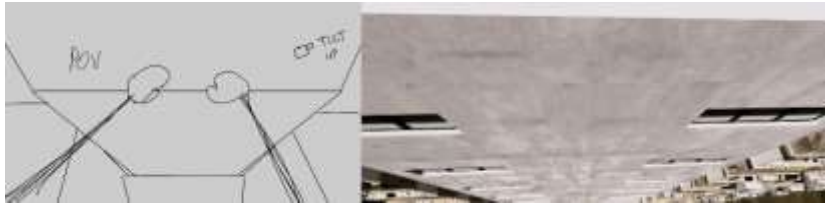*Figure 5.2.11: The output is consistent with the storyboard*

Figure 5.2.12: The output is consistent with the storyboard

Figure 5.2.13: The output is consistent with the storyboard

Figure 5.2.14: The output is more wide angled than the storyboard

Figure 5.2.15: The hands could not be added

Figure 5.2.16: The output is consistent with the storyboard

Figure 5.2.17: The output is consistent with the storyboard

Figure 5.2.18: The salesman is on a different building

Figure 5.2.19: The salesman is on a different building

Figure 5.2.20: The mural is facing the other direction

Figure 5.2.21: The output shot is less wide than the storyboard

Figure 5.2.22: The output shot is less wide than the storyboard

Figure 5.2.23: The output shot is less wide than the storyboard

Figure 5.2.24: The output has been changed from the storyboard

Figure 5.2.25: The output shot is less wide than the storyboard

Figure 5.2.26: The output shot is less wide than the storyboard

Figure 5.2.27: The output shot is less wide than the storyboard

Figure 5.2.28: The output shot is less wide than the storyboard

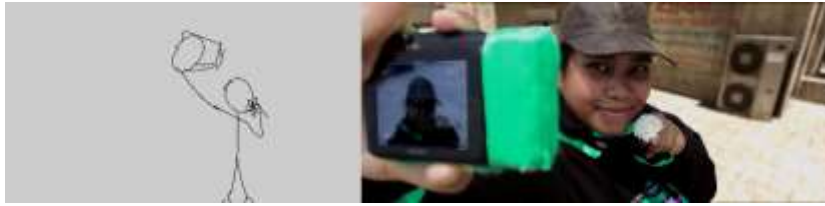*Figure 5.2.29: The output has different angle from the storyboard*

Figure 5.2.30: The output has different angle from the storyboard

Figure 5.2.31: The output is consistent with the storyboard

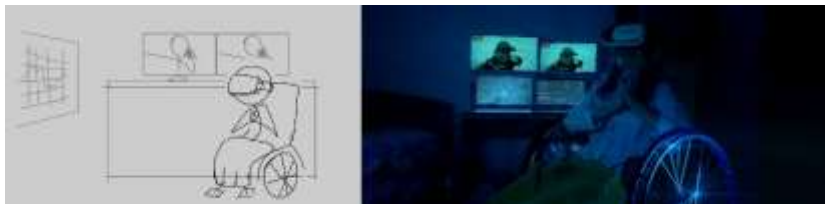*Figure 5.2.32: The output is consistent with the storyboard*

Figure 5.2.33: The output angle is different from the storyboard

Figure 5.2.34: The output is consistent with the storyboard

Figure 5.2.35: The output is consistent with the storyboard

Figure 5.2.36: The output is consistent with the storyboard

Figure 5.2.37: The output is consistent with the storyboard

5.3 Challenges Faced

One of the challenges faced when creating this short film is that lack of experience and time resulted in me not being able to film shots where the camera was moving. This was also in part due to not having advanced film equipment like camera dolly and camera crane. Nonetheless, the static camera shots were manipulated in 3D virtual environment which was done effectively.

Another challenge that I had faced was that the animation felt a bit 'choppy,' as the feedback I gathered from my audiences suggested. This was because footage of real life is smooth, and converting that to fit animation principles can have variable frame rate.

Figure 5.3.1 A still frame feels off within the flow of the film

The last challenge that I faced was that in many animated films, there are still shots consisting of a single frame held for a long time, which fits with the animation of the film, but it does not translate effectively in my case of animation stylization of real footage. A still frame in the middle of moving frames feels uncanny and off.

5.4 Course Covered

Through my project, I attempted to cover the courses of

- Film Studies & Appreciation
- Video Production, Digital Cinematography
- Techniques of Film Making
- Fundamental of Graphic Design
- Typography Design, Project Management
- 2D Animation
- Motion Graphics
- Audio & Video Streaming
- 3D Modeling
- Lighting & Rendering
- VFX & Matte Painting

CHAPTER 6
DISCUSSION

"Roofscape Runner" is a multidimensional short film combination of video production, Motion graphics, 2D animation, 3D, Matte painting, and VFX. It is a film that was made with great passion in order to show that it is possible to create a short film that incorporates real life footage and animation principles and visual effects.

It is a short film that portrays a woman who likes to perform parkour actions throughout a busy rooftop scenery in a futuristic sci fi urban settings. It shows that with free running like this, there comes a sense of freedom. This freedom is felt by her audience for whom she records her running journeys.

CHAPTER 7
CONCLUSION

Through this project I wanted to expand on experimental film and animation with a concept I am deeply passionate about, which is creating visual effects and animation using real life footage. It is a very stylistic film which I want society to learn about and adapt into more films and animation throughout the world.

The completion of this project was like a dream to me since it was a very difficult undertaking. I had prior experience in creating short films of only animation medium, but this was the first time that I had filmed and moreover incorporated the filmed footage and elements into a hybrid film, a mixture of real life footage and animation using animation principles and visual effects.

CHAPTER 8
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