# AN OPEN WORLD WINDOWS GAME BASED ON DAFFODIL INTERNATIONAL UNIVERSITY

## BY

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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**DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA, BANGLADESH**

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# APPROVAL

This Project titled "**An open world windows game based on Daffodil International University**", submitted by Md. Nahid Sharif and Mirza Shahriyar Rahman to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 25th January 2023.

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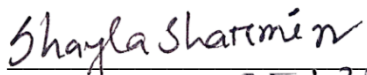Faculty of Science & Information Technology
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# DECLARATION

We hereby declare that this project has been done by us under the supervision of **Mr. Narayan Ranjan Chakraborty, Associate Professor, Department of CSE** 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.
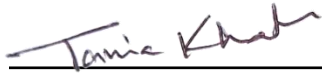
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Finally, we must acknowledge with due respect the constant support and patients of our parents.

# ABSTRACT

"An open world windows game based on Daffodil International University". Here, our core motivation for this project is to promote our in the digital world. As technology continues to advance and virtual realities such as the metaverse and augmented reality become more prevalent, the need for digital spaces where people can interact and express themselves grows. We aim to provide such a space, serving as an open canvas for creativity and socialization. Through this project, we hope to promote their presence in the digital world and foster a sense of community within their university. By creating a digital space for people to come together and share their experiences, "DIU Drive Way" seeks to bring people closer together and provide a platform for connection and expression in the digital realm. The primary implementation was troublesome but after this anyone can edit and change it to anything they see fit as long as they have proper hardware. It will also be a way to make a way to implement various kinds of modes and features that anyone can add very easily. Creativity of any group has very huge potential so by making this open source and relaying it to the students will lead to create many unique works in the future.

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# CHAPTER 1

# Introduction

## 1.1 Introduction

"DIU Drive Way" is a computer game that aims to provide players with an immersive and interactive experience of the university. As a place of higher learning and personal growth, universities are often considered a microcosm of the world at large, offering a diverse and dynamic community for students to be a part of. By this project we seek to capture this sense of community and exploration by allowing players to roam through the university grounds and discover all that it has to offer. Not only does this project provide a virtual tour of the university, it also serves as a tool for learning and discovery. Players can learn about the various facilities and resources available to them, as well as get a sense of what the university has to offer in the future. Additionally, the game can be used by employees to make changes and modifications to fit the evolving needs of the university. Overall, "DIU Drive Way" is a unique and innovative project that seeks to bring the university experience to life in the digital realm. Through immersive gameplay and interactive learning opportunities, it offers a dynamic and engaging way for students and employees to explore and engage with their university.

## 1.2 Motivation

At present the use of game is rising as well as gaming community. We want to walk up to that trend. Making games is a challenge for anyone, but with few simple techniques it can be very easy to learn. We want to create an open world 3D space where a player can game as well as know about that environment. As human being we're already moving toward a digital future like VR and AR, next human evolution might be getting into the digital space with this we can have an idea of what is feels like.

### 1.3 Objectives

- Roaming the University Grounds.
- Exploring all iconic location.
- Drive with various cars.
- Having a fun environment.
- Variable Camera Direction.
- Promoting food shops and local brands
- A platform to attract students to become developer in "Game Industry"
- Help to build a mascot in the digital world.
- Students can know various rules and information of the university.
- Encourage student to be a game developer.

### 1.4 Expected Outcome

With this game we want to create an environment where a player can roam freely and have an idea and the feel of nostalgia. As last year students, we wanted to remember our university as long as we could. Similarly, share this moment of enjoyment to everyone including those who have already graduated from our university. Also, this will encourage more people towards game development industry as well as engineering department as a whole. It'll be available to the future students to modify and keep the environment up to date. This will also show the importance of a digital presence and its usefulness to more infrastructure in the future.

### 1.5 Project Management and Finance

To successfully complete "DIU Drive Way," we employed the use of Trello, an online project management tool. We opted to follow the agile model of software development due to its flexibility and simplicity. The agile approach emphasizes self-organization, direct communication with users to determine requirements, and the ability to quickly respond to changes and continuously develop the project. [1] We were able to complete this project without any financial assistance aside from the electrical costs of our computer hardware, utilizing the resources we had available to us. The agile model proved to be a great fit

intended for our needs, allowing us to efficiently and effectively bring "DIU Drive Way" to fruition.

## 1.6 Report Layout

Our project report consists of seven chapters. Which are in chapter 1 Introduction, we describe Introduction, Motivation, Objectives, Expected Outcomes, Project management and Finance, Report Layout. In, chapter 2 Background, then Preliminaries/Terminologies, Comparative Analysis, Related work, Scope of the Problem and Challenges. In, chapter 3 Requirement Specification, here is Preliminaries/Terminologies, Related work, Comparative Analysis, Scope of the Problem and Challenges. In chapter 4 Design Specification, we have discussed about Business Processing Model, Requirement Collection and Analysis, Use Case Modeling and Description, Logical Data Model and Design Requirement. In, chapter 5 Implementation and Testing, at this portion we talk about Implementation of Database, Implementation of Front-end Design, Testing, Test Results and Reports. In, chapter 6 Impact on Society, Environment and Sustainability, we have entered our project's Impact on Society, Impact on Environment, Ethical Aspects and Sustainability plan. In, chapter 7, Conclusion and Future Scope is the last topic.

# CHAPTER 2

# Background

## 2.1 Preliminaries/Terminologies

Our project is based on open world games. We had to create a large environment. So, player needs to travel from point A to B using some sort of moving mechanism. Here we implemented moving car with fixed virtual camera to follow around. In this project we used Unity open-source assets and C# as programming languages. Most of the models are created from blender and some other 3D tools.

The terminologies used as follows:

- Unity
- Universal Render Pipeline (URP)
- Blender, Maya, Autodesk
- C#
- PhysX
- Global Illumination, Local Illumination
- Low Poly

## 2.2 Related Works

As we know there are already multiple works in the gaming industry about racing and exploration. But recently various massive game development studio is making scenario-based games with nothing but keeping exploration mechanics on primary focus.

- Assassins Creed Discovery Mode (UBI Soft)
- Yonder: The Cloud Catcher (Prideful Sloth)
- East Shade (Eastshade Studios)

## 2.3 Comparative Analysis

As rule of thumb each and any kinds of games is similar to one or another in some way. But in our project, we exceled toward making this as close to a unique experience as possible. Generally, the environment of a game set it apart from everything else. So, we have created most unique environment which is possible with our knowledge.

## 2.4 Scope of the Problem

Our university has and will do many great things in future. But still there are no games developed or represented by the university and we aim to change this. This not only applies to our university but if affects all kinds of infrastructure that deal with these kinds of user such as- students, children, those who want to explore but can't due to various difficulties. It will Spread the market for our local products and also help the local artists to get their proper wages. Besides, it is also a problem to get an authentic product of an area in another area. So, by this project we can also solve this problem and provide the product of one area to another area easily.

## 2.5 Challenges

The primary problem we faced is the hardware limitations of our workstation. As a student it's not really possible to afford a workbench to perform multiple heavy workloads like 3D modeling, Audio Editing, Video Editing, Particle Sim, Polygon Count. These take up to 64 gigs of memory, over 8 gigs of Graphics DRAM to load if done simultaneously which was not possible for our setup. So, we had to do various work without knowing that the end product might be.

## 2.5.1 Development Purpose

In order to complete this project, we had to create to learn quite a few things life Unity Game Engine and its subsequent language C#. After this we also had to learn blender as well as Autodesk for various 3D models and its properties. It was a fair challenge but, in the end, we pulled through and completed our designated tasks. C# is used for coding in the car control and game modes, other were used for modeling and the game engine itself created the URP.

## 2.5.2 Working Purpose

In the development of "DIU Drive Way," we worked with 400 3D models, requiring us to import and create resources as well as check for any licensing issues with online models. Additionally, we incorporated water simulation and physics variables into the game, which required careful implementation. We also utilized multiple reference photos to ensure the

quality of the assets used in the project. The final project was quite large, but we were able to effectively manage its size thanks to Unity's compression system. Overall, working with 3D models and various simulation and physics variables presented challenges, but we were able to successfully overcome them to create a high-quality final project.
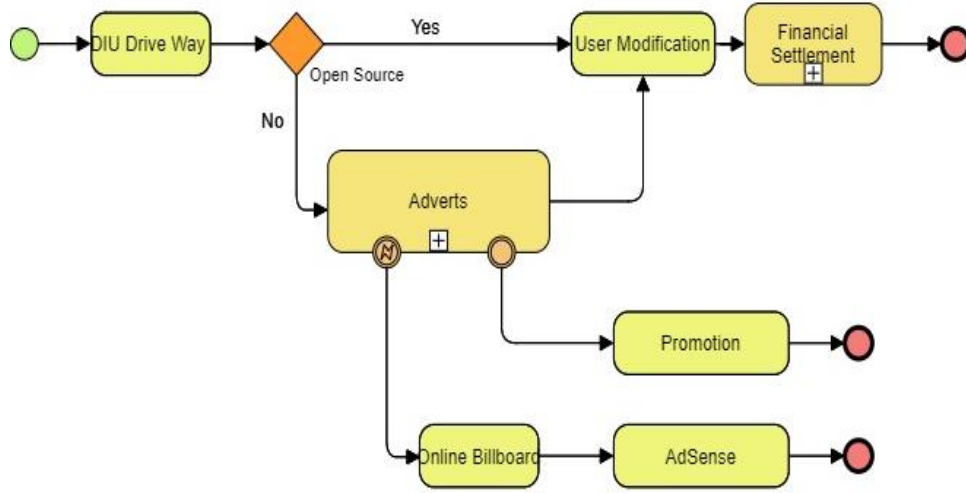


Figure 3.1: Business processing Model

# CHAPTER 3

# Requirement Specification

## 3.1 Business Processing Model

The business model for "DIU Drive Way" is centered around passive forms of revenue generation, such as promoting the game, implementing ads and ad placement, and utilizing recommendation algorithms. As an open-source game, it can be modified and used without incurring any licensing costs, allowing for a greater potential reach and user base. At present, the primary focus for this project is on using the game as a promotional tool for the university's infrastructure. It can be utilized in events or to encourage others to participate in game development, helping to raise awareness and showcase the capabilities of the university. While the passive revenue streams are currently the main focus there may be opportunities to explore other business models in the future. For example, the game could potentially be used as a teaching aid or as a platform for virtual events, both of which could generate additional revenue. Ultimately, the business model for "DIU Drive Way" will depend on its success and the evolving needs and goals of the university.

## 3.2 Use Case Modeling and Description

Software Requirements:

❖ Windows OS: Microsoft Windows, also called Windows and Windows OS, computer operating system (OS) developed by Microsoft Corporation to run personal computers (PCs). [2]

❖ DirectX12: DirectX 12 (DX12) enables developers to add amazing graphics effects to Microsoft Windows-based PC games. GeForce graphics cards deliver advanced DX12 features such as ray tracing and variable rate shading, bringing games to life with ultra-realistic visual effects and faster frame rates. DirectX 12 (DX12) enables developers to add amazing graphics effects to Microsoft Windows-based PC games. GeForce graphics cards deliver advanced DX12 features such as ray tracing and variable rate shading, bringing games to life with ultra-realistic visual effects and faster

frame rates. [3]

Hardware Requirements:

- ❖ Operating System: Windows
- ❖ Computer configuration:
    - RAM- 4GB
    
    (min)
    - Storage - 20GB (SDD for faster load time)

- ❖ Display configuration:
    - FHD Display Native (1080P)
    - Frames Rate (min-30 FPS)

- ❖ Audio configuration:
    - Audio Driver
    - ACC, Mono, Stereo

- ❖ HID configuration:
    - Keyboard
    - Mouse

So, these are the requirements on order to run our finished project as the 'executive (exe)' file in windows. But as developer we required some other capabilities. We needed to use a better hardware compared to the user/player apart from common I/O.

For hardware we needed-

- Graphics Card 16 GB
- Processor i7 8G or M1 Silicon
- Memory 16 GB
- Storage 50 GB (SSD)
- High bandwidth

For software support at the development needs are the same as the player or user apart from the unity integrated development environment (IDE) and other software like Autodesk, blender to create, modify and export 3D models and assets.

Lastly for coding we needed to use C#, Java.

## 3.3 Use Case Modeling and Description

The Use-case model is defined as a model which is used to show how users interact with the system in order to solve a problem. As such, the use case model defines the user's objective, the interactions between the system and the user, and the system's behavior required to meet these objectives. [4] Figure 3.2 shows the use case model of our game. We have three type of use case- Admin, developer and user. Each of them has their own role and it corresponds with one another. Every use case has other task to complete or report to another.
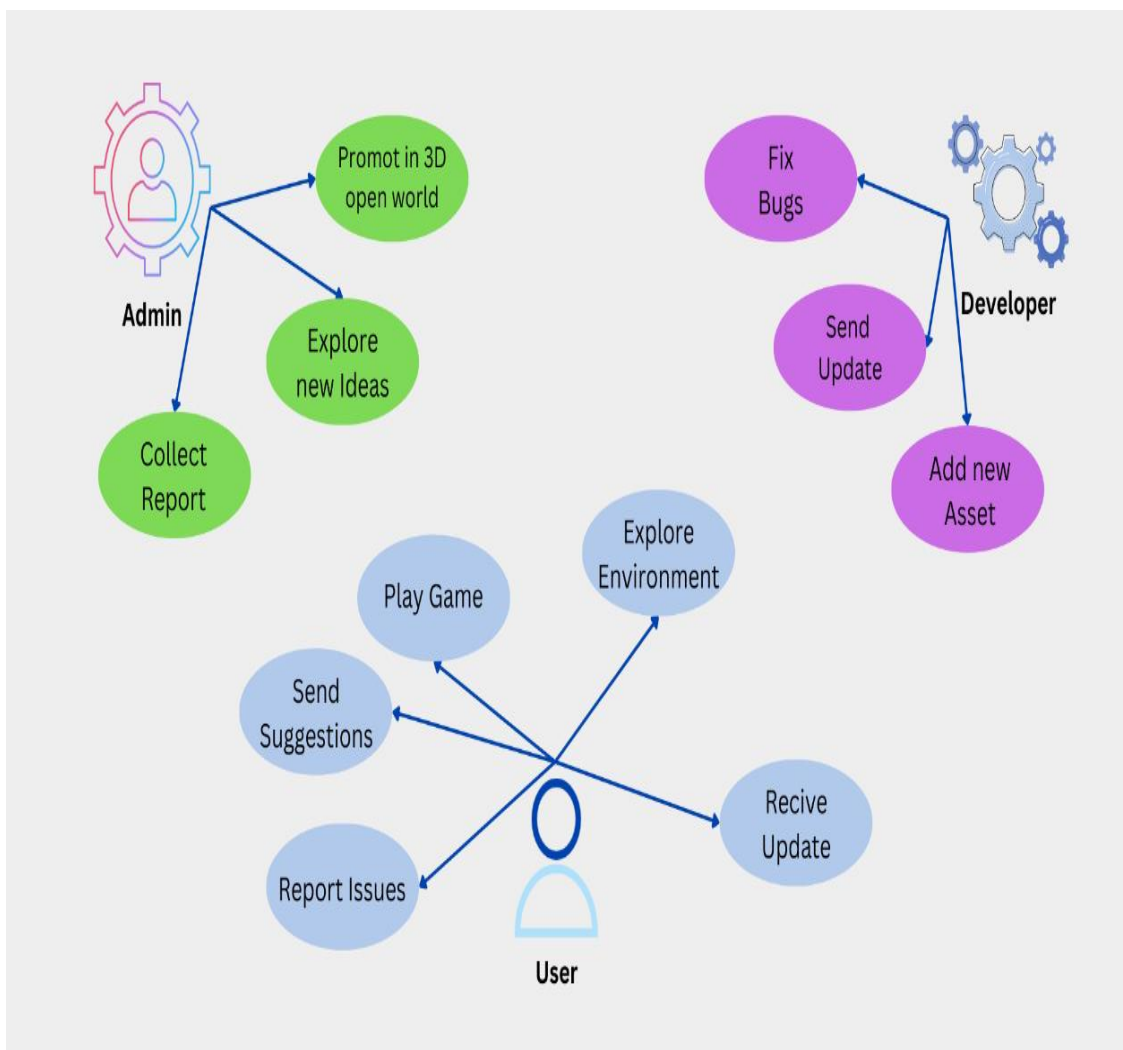


Figure 3.2: Use case model diagram

Use case details:

Here, the admin can import the assets as well as update and remove the assets.

TABLE 3.1:  USE CASE OF IMPORT ASSETS.

| Use Case Name | Import Assets |
|---|---|
| Use Case Details | Importing variable assets to unity. |
| Pre-condition | FBX file for proper implementation |
| Actor | Developer |
| Post- Condition | |

Here, loads all scene to recreate the output of the project.

TABLE 3.2: USE CASE OF SCENE

| Use Case Name | Scene |
|---|---|
| Use Case Details | Loading assent and script into scene |
| Pre-condition | Imported rendered assets |
| Actor | Developer |
| Post- Condition | |

Here the admin can inspect the all over view of our site and its work

TABLE 3.3: USE CASE OF INSTALLATION

| Use Case Name | Installation |
|---|---|
| Use Case Details | Process for installation of the game |
| Pre-condition | Downloaded Game File |
| Actor | User, Admin |
| Post- Condition | Extracted all files |

Here, vendor can check their best-selling products and can store the record.

TABLE 3.4: USE CASE OF OPEN APPLICATION

| Use Case Name | Launch Application |
|---|---|
| Use Case Details | Upload the product as its supply, it can be bulk and normal. |
| Pre-condition | Extracted resources |
| Actor | User, Admin |
| Post- Condition | Feedback |

Here the vendor can upload the product and can update product's details

TABLE 3.5: USE CASE OF PATCH, SUGGESTION

| Use Case Name | Patch, suggestion |
|---|---|
| Use Case Details | Get feedback from customer |
| Pre-condition | Get feedback, reports, error from user |
| Actor | Admin |
| Post- Condition | Relay instruction to developer |

Here the  vendors and customers view their profile page and can  update their information.

TABLE 3.6: USE CASE OF UPDATE APPLICATION

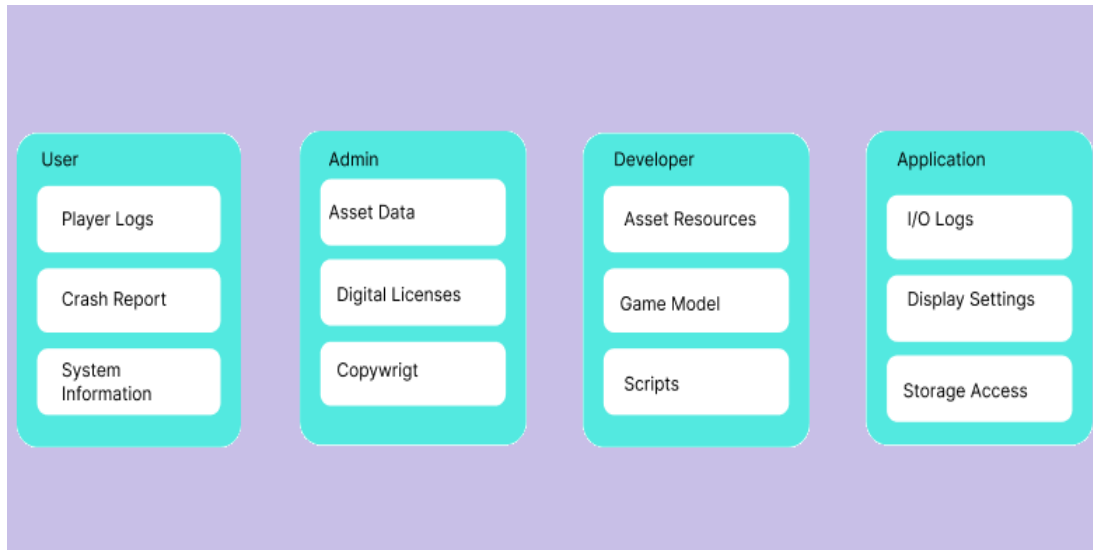| Use Case Name | Update Application |
|---|---|
| Use Case Details | Vendor and customer can view and update their profile |
| Pre-condition | Fix bugs, implemented suggestions |
| Actor | Developer, Admin |
| Post- Condition | Upload Package |

## 3.4 Logical Data Model



Figure 3.3: Logical data model

Four tables are created to design the database of our project. The tables are User, Admin, Developer and Application. The attributes of the tables are player logs, crash report, System information, required data for Admin are asset data, Digital Licenses, Copyright. Data for Developer are asset files, model, scripts. Application data are, I/O logs, Display settings, Storage. All the tables of data model are independent from one other.

## 3.5 Design Requirement

Blender's comprehensive array of modeling tools are used for creating, transforming, sculpting and editing our models. [5] Because of Unity's built-in integration module, we can directly import as FBX then post process in the Unity Scene.

# CHAPTER 4

## Design Specification

**4.1 Front-End Design**

Front The front end of a website is everything the user either sees or interacts with when they visit the website. It is responsible for the total look and feel of an online experience. [6] Here are the GUIs of the front-end design of our project "DIU Drive Way".

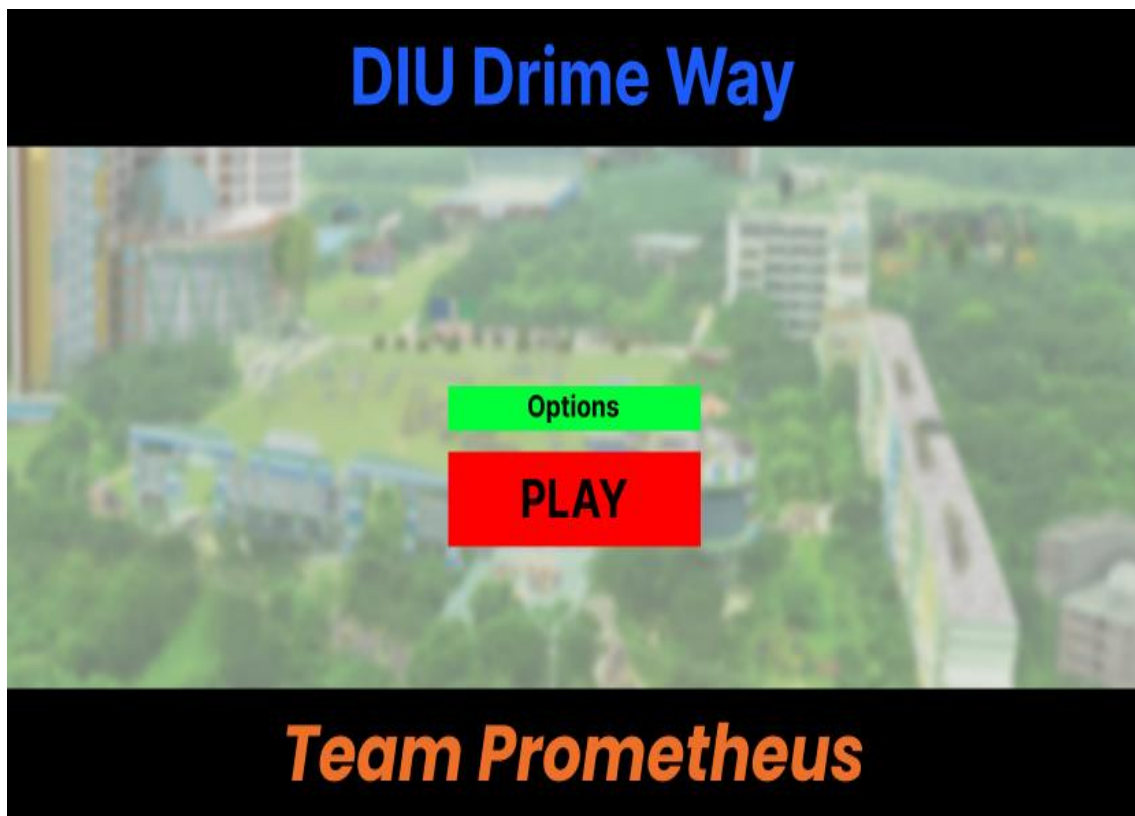- ▪ This is the main page of game application after launch.



Figure 4.1: Main menu

- Here is the instruction page for properly playing the game.
- We've used both right hand side and left-hand side controls
- As well as a pause menu to revisit controls in case the user forgets.



Figure 4.2: Options & controls

- This is the top view of the full game scene.
- User could explore from an arial view if this were to implement.
- All assets are presents



Figure 4.3: Top view

- Camera view to first person player.
- Camera will only follow the car dash board
- Options for changing cars will still be available



Figure 4.4: First person view

- This user camera view for dash cam mode for the game.
- Camera will follow the car engine hood.



Figure 4.5: Dash cam view

- This is the inspection view for the developer.
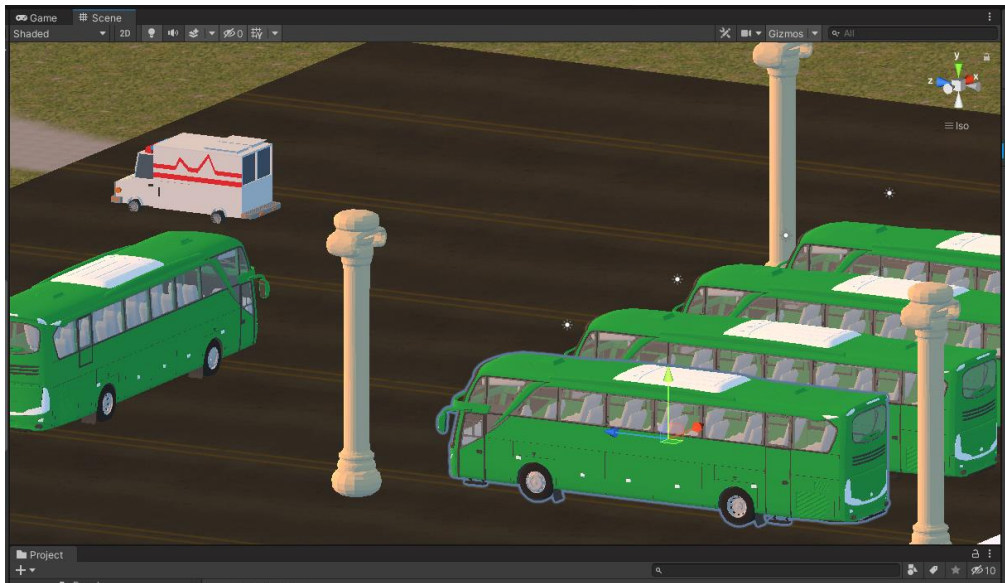- Developer can inspect any models in the unity.



Figure 4.6: Inspection view

- Here is the cinematic camera view for player.
- The mode will follow a curved path
- It'll vary from one car to another



Figure 4.7: Cinematic view

- This is a physics model visualization amongst several physics model.
- Basics of weight principles are added but it's enough to make it airborne.
- It can also allow a player to jump off an obstacle or get stuck in terrines.



Figure 4.8: Physics model

- This is the GUI of gauge cluster with built-in tachometer.
- We've embedded a logo
- It also contains meter for Nitro/NOS



Figure 4.9: Gauge cluster

**4.2 Back-End Design**

Back-end of any project was done by unity. It is invisible to both client and administrator. Its running on background in within unity. Our back-end was done mostly by C# and java for few occasions. After implementing scripts and unity plugins all the models can be modified through the unity control panel. But there are few elements that player can control which are "Shadow Settings" & "Frame Counter". When player toggles the switch it'll either turn the function off or on within the game from back-end.

Tools for back-end design:

- Unity IDE
- VS Code
- Visual Studio
- Java
- Unity Framework
- Terrain builder
- Physics simulator
- Universal Render Pipeline
- Unity Crash Handle
- Script
- Particle simulation
- Road Kit
- Camera Kit

**4.3 Interaction Design and User Experience**

Interaction Design (IxD) is the design of interactive products and services in which a designer's focus goes beyond the item in development to include the way users will interact with it. [7] In simplified terms, it's the refers to the interaction between users and products. In our case our UI is very minimalistic to use and easy to navigate. Our site is user friendly and beautiful, which is why people can easily use this site. User experience (UX) design is the process design teams use to create products that provide meaningful and relevant experiences to users.[8]. In our game we tried to keep only the meaningful and impactful UI elements.

- A developer can modify, create, add attributes to any assets within unity.

- They can also trigger an event system to add various system within the game.

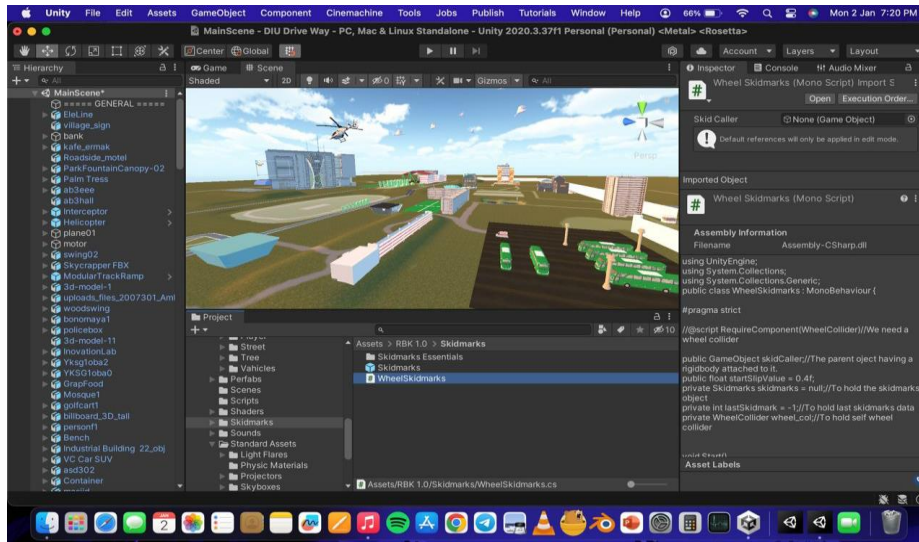- It can also be used to make camera, lights and physics variables.



Figure 4.10: Development Process

- This is the Pause/Options Panel for the game

- I'll also feature the control menu

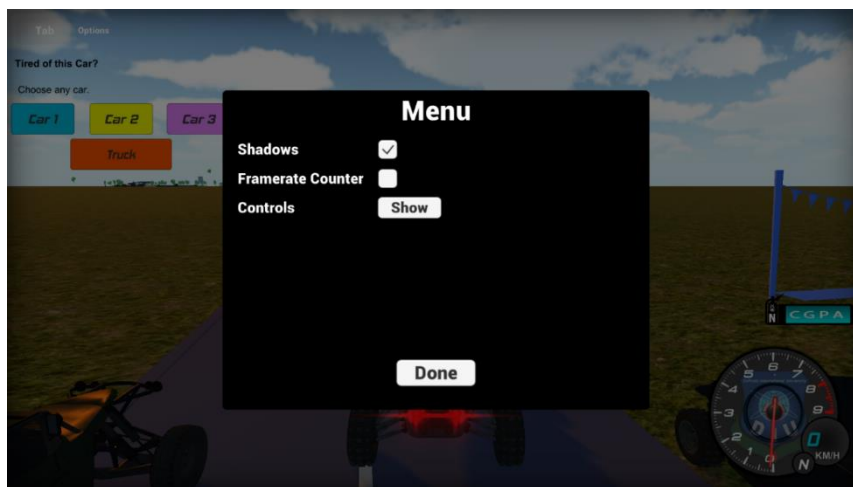- As well as toggle switch for some functionalities



Figure 4.11: Settings Menu

- Here is the toggle for Shadow and Framerate counter. Turning off shadow will consume less resource of the system and turning on the Framerate counter will show if the game is running at desired FPS.

- More options can be added here.
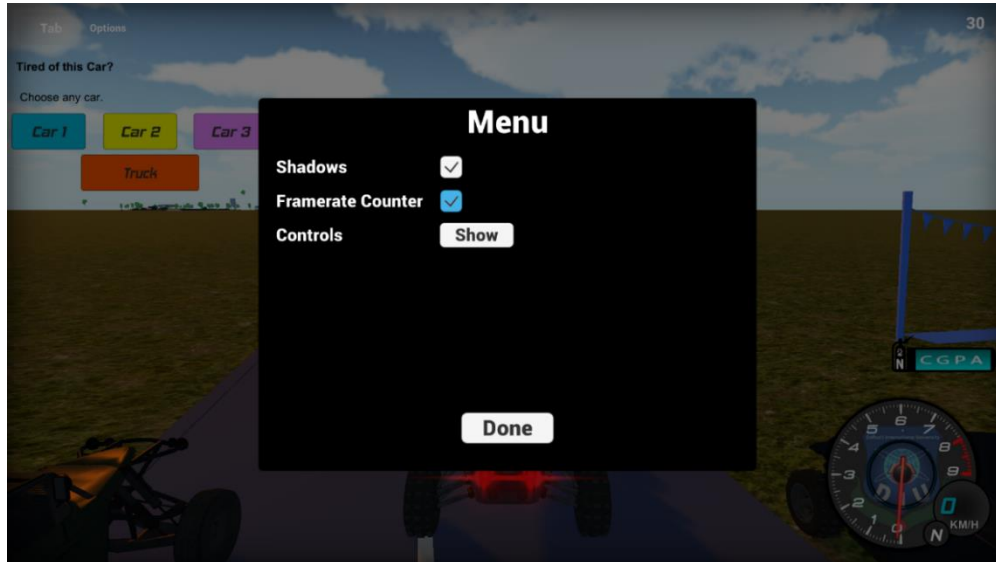


Figure 4.12: Toggle Switch

- This is where user can click to change car.

- There are four car options at this moment.

- More cars can be added in future.
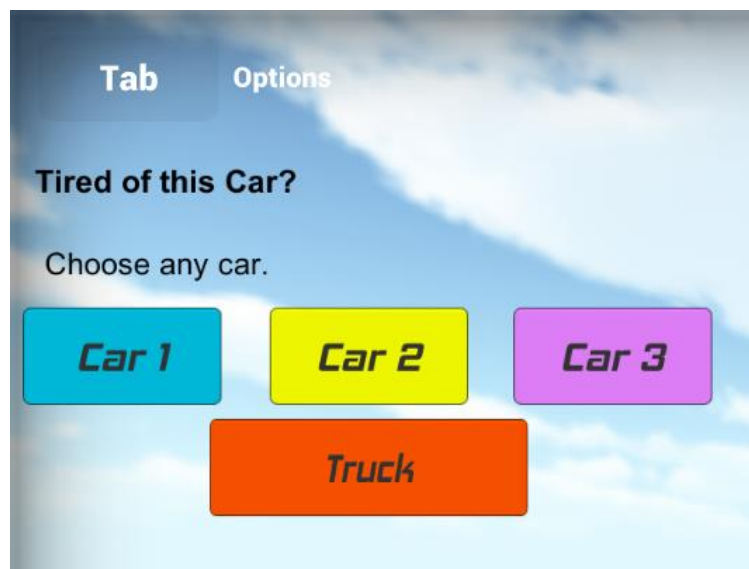


Figure 4.14: Car Variables

- Here is our inspector where the developer can check the total characteristics of game object and can be modified easily. This is one instance of a model there are around the 400 models which are similar after completely done similar to this script.



Figure 4.14: Inspector Panel

- This represents the Nitro/Boast meter for our car speed.

- The bar is created with adobe illustrator.

- It'll animate to red when bar is empty.

Figure 4.15: Nitro Meter

- This is the last-minute spark that added depth to the game which is water sim.
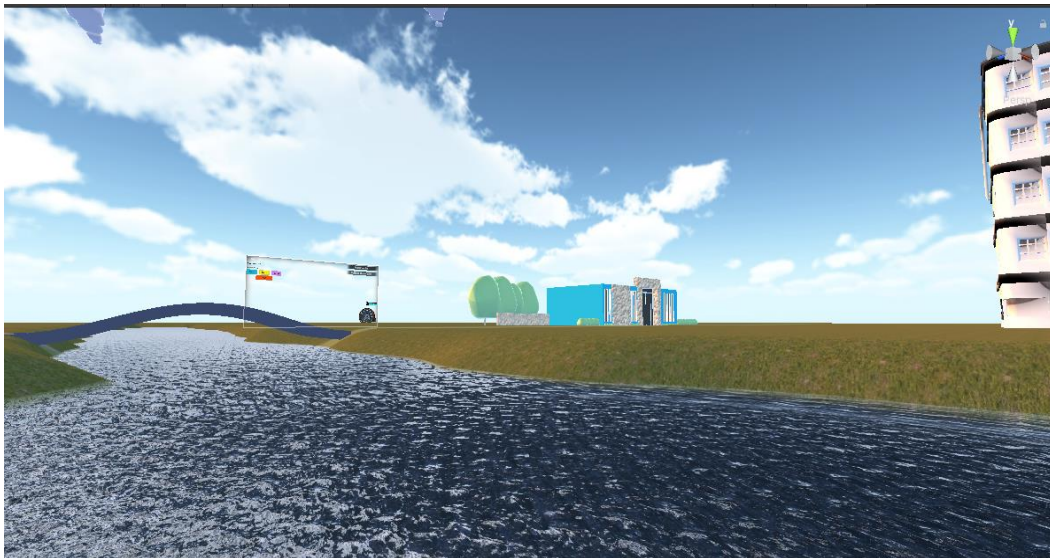
Figure 4.16: Water Simulation

- This is the website contains stable release of the game

- There is a section for patch notes

- Beta version of the game

- Developer info

- Beta version

- Project documentation

- Project video

- Installation guide.

- Developer contact information

- Online Support

- A user feedback section
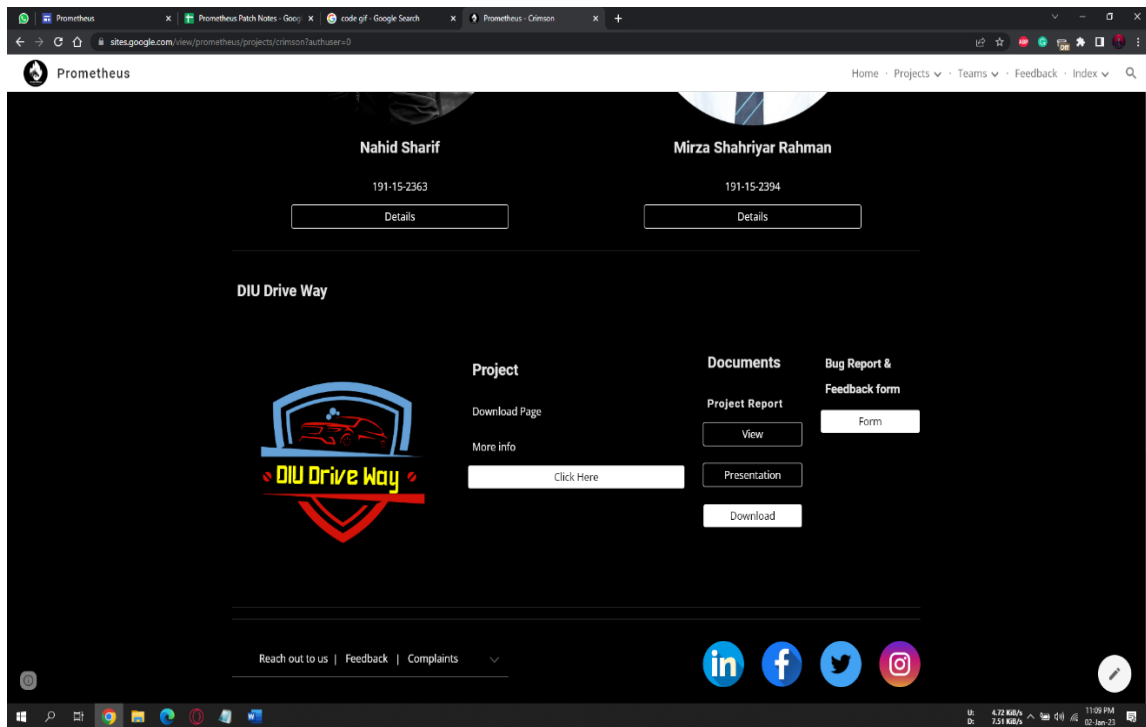


Figure 4.17: User Installation Guide

- This represents the download menu of current game version for both Stable and Beta Release as well as patch notes.
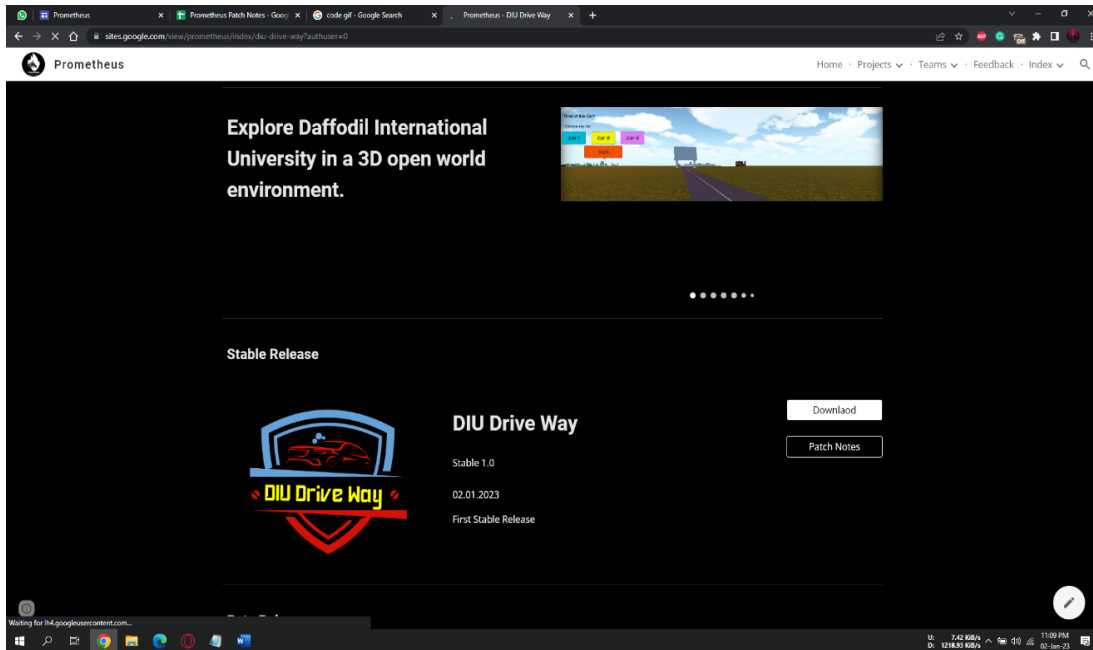


Figure 4.18: Download Menu
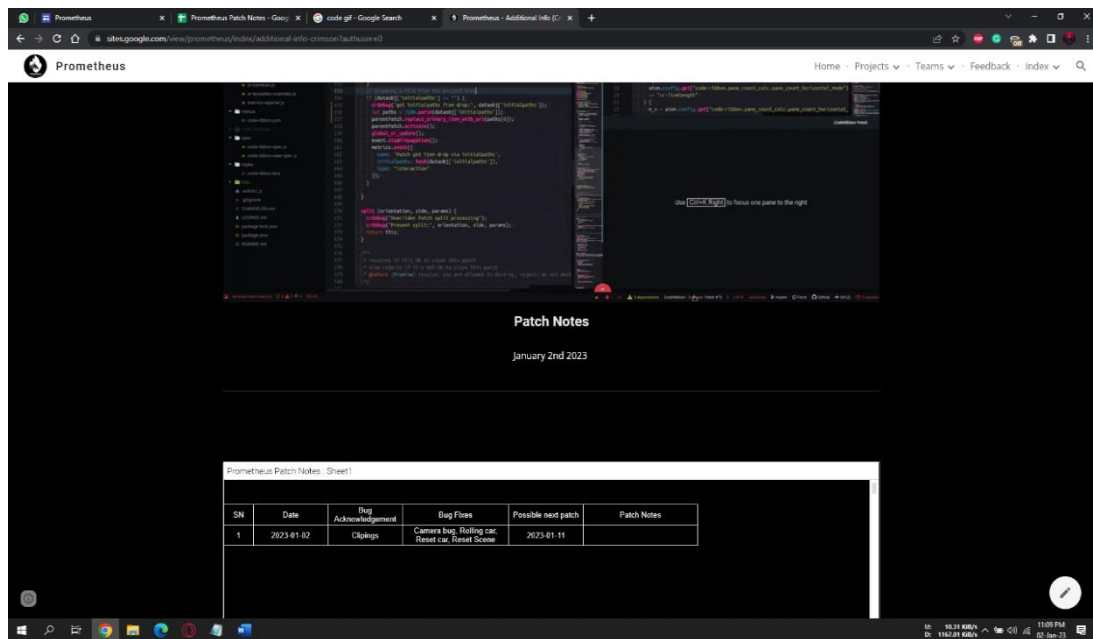


Figure 4.19: Patch Notes

- Also, this is our feedback and reporting section which are read by the admin.
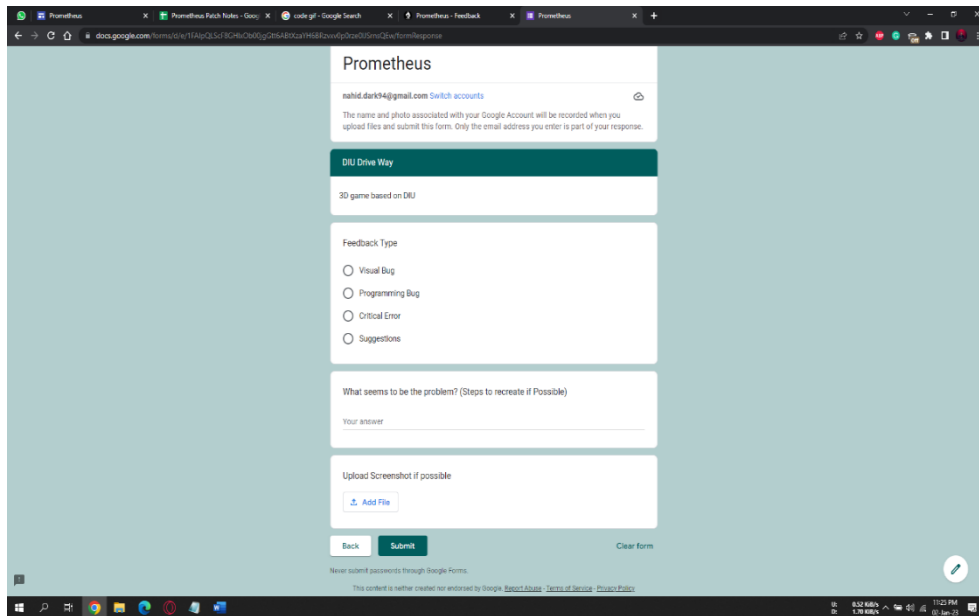


Figure 4.20: Feedback Section



Figure 4.21: Report Section

## 4.4 Implementation of Requirements

In order to develop our game, we used unity. Unity requires to have a good command over basic C#, graphics capabilities for 3D game making, fast storage as it's real-time development.

# CHAPTER 5

## Implementation and Testing

### 5.1 Implementation of Database

In our project we used Local Machine to store all the data, unity auto handles crash report. All the information is stored in logs and can be connected with unity cloud server to provide real-time analysis. Unity needs to convert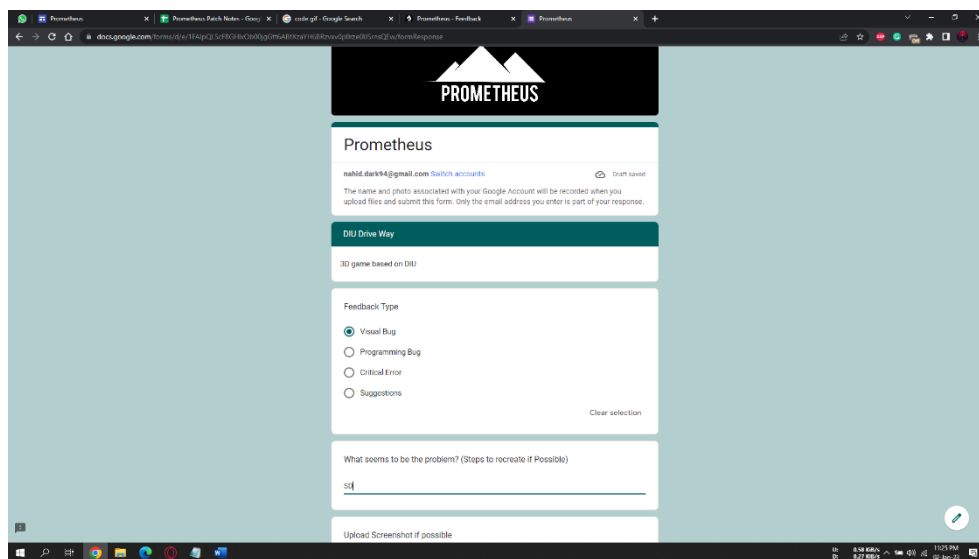 the data from the asset's source file into a format that it can use in a game or real-time application. It stores these converted files, and the data associated with them, in the Asset Database. In case of new of any asset- the texture, Unity creates a new representation of the image in a different format which is stored in the Project's Library folder. [9]

### 5.2 Implementation of Front-End Design

The front end is the part of the website users can see and interact with such as the graphical user interface (GUI) and the command line including the design, navigating menus, texts, images, videos, etc. [10] In our case we have to show game UI, Object, Virtual Camera. UI Toolkit is the newest UI system in Unity. [11] It's designed to optimize performance across platforms, and is based on standard web technologies. We use UI Toolkit to create extensions for the Unity Editor, and to create runtime UI for the game.

### 5.3 Test Implementation

Test implementation and execution is the activity where test procedures or scripts are specified by combining the test cases in a particular order and including any other information needed for test execution, the environment is set up and the tests are run. [12] They can implore several methods such as-

- Black Box method
- White Box method
- Gray Box method

## 5.4 Test Result and Reports

In this portion, we implement several methods to test our project with multiple runs of each tests. For this we were mostly focused on virtual camera, and scene which is both successful.

TABLE 5.1: TEST RESULTS

| Test Case | Test Input | Expected Outcome | Obtained Outcome | Pass/ Fail | Testing Period |
|---|---|---|---|---|---|
| Proper Scene | Open Application | Launched with all assets | Launched with all assets | Pass | 04.01.2023 |
| Virtual Camera | Move Car | Follow Car | Follow Car | Pass | 04.01.2023 |
| Lighting | Use Break & Reverse | Proper light indicator | Proper light indicator | Pass | 08.01.2023 |
| Proper Control | All Movement keys | Move toward correct trajectory | Move toward correct trajectory | Pass | 09.01.2023 |
| Toggle Shadow | Turn off Shadow | Shadow is off | Shadow is off | Pass | 12.01.2023 |
| Toggle FRC | Turn on FRC | FPS is Shown | FPS is Shown | Pass | 14.01.2023 |
| Get Update | Click Download | Update Successful | Update Successful | Pass | 18.01.2023 |

# CHAPTER 6

# Impact on Society, Environment and Sustainability

## 6.1 Impact on Society

These kinds of system generally encourage any youth to try because it's a game. It encourages to move towards becoming a game and increased amount of game developers in Bangladesh. But of course, there are some adverse effects to this as well encouraging the youth towards games will encourage many who just waste their time in game without developing essential skills. In addition to promoting socialization and connection, "DIU Drive Way" can also serve as a tool for learning and personal growth. By allowing players to explore the university grounds and learn about the various facilities and resources available to them, the game can help to promote knowledge and understanding. This can have a ripple effect on society at large, as educated and informed individuals are better equipped to contribute to their communities and make a positive impact on the world.

## 6.2 Impact on Environment

Even though components required to run and develop game have effects on the environment. But it is based on the entire "Digital Devices" which uses natural materials such as Copper, Nickel, Gold, Zinc. [13] With everything combine the total emission of carbon is around 3.7% according to some study. [14] But this study also includes the same amount when 4.1 billion people send out an email will be same as developing a game on that same machine. In our case "DIU Drive Way" is an offline game and mostly green apart from the energy generation which is done by burning coal, gas or oil.

## 6.3 Ethical Aspects

When people hear about game the thinks its harmful to everyone. Some study does suggest video games can cause violence, [15] others disagree like Professor Andrew Przybylski, Director of Research at the Oxford Internet Institute. [16] reality is simple that even religion can be dangerous with wrong understandings. Also, most these doesn't apply to us because this is a simple exploration-based game to relax.

**6.4 Sustainability Plan**

Sustainability plan is the roadmap for achieving long-term goals and documents strategies to continue the program, activities, and partnerships. [17] Here to sustain our project we will always the services up for any player or admin who wants to work on this project or help us make this better by contributing their feedback. Also, this game is an offline non digital ownership material so it'll continue to run as long as the windows API supports it. So, the longevity of this project is very high.

# CHAPTER 7

## Conclusion and Future Scope

**7.1 Discussion and Conclusion**

The project is completed project is completed Unity, 3D modeling tools and C#. Anyone who have a decent windows machine can run this game. To implement this, we had to learn Unity Game Engine and how its module work, also few things about 3D modeling. We collect some of our resource from open-source projects and websites and collected other models by recreating them. Afterward, we conducted an Idea which was the exploration system as well as the idea of making a digitized a physical environment. Then we implemented a prototype game to test out our hypothesis that this could work. For this we collected several videos and picture of our university to implement this in the digital space. After finalizing that the prototype works, we move forward to GUI design of our game and started to add resources and scripts to make it come together brick by brick. Staring was the main issue but building on it was not that difficult to do. As we've used a software model, we're able to finish this project even though it had many changes. First, we added a movement object that just goes as block. Then we implemented the virtual camera which will follow the block. After that with help of the internet we're able to make an entire car move with respect to the map. Lastly, we implemented light illumination as well as animations such as driver position and break lights. The project is now in its infancy we're hoping to get more unique and creative things out of this in the future. Our project will help to spread the need of digital space in these kinds of infrastructure. That will also give our student morale boost. Overall, "DIU Drive Way" has the potential to make a meaningful and lasting contribution to society by fostering connection, community, and learning.

**7.2 Scope for Further Development**

At the moment the game only supports Windows OS and its offline use only. In future the support for cross platform plays as well as a web application is a very probable factor. Multiple maps can be added with different geography. Flying vehicle such as drone or helicopter can be implemented as the mode of transportations. Detailed inside models are very easy to add with higher configurations of hardware.

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