

SIX WEEKS SUMMER TRAINING
REPORT
on
**ONLINE CERTIFICATE COURSE IN 3D AND AUGMENTED
REALITY USING UNITY GAME ENGINE**

Submitted by
SURYA

Registration No = **11903382**

Program Name:
COMPUTER SCIENCE AND ENGINEERING (Hons)

Under the Guidance of
Mr. GURPREET SINGH SHAHI

School of Computer Science & Engineering
Lovely Professional University, Phagwara
(June-July, 2021)

DECLARATION

I hereby declare that I have completed my six weeks summer training at **HRDC, Lovely Professional University, Punjab** from **07/06/2021** to **16/07/2021** under the guidance of **Gurpreet Singh Shahi**. I have declared that I have worked with full dedication during these six weeks of training and my learning outcomes fulfil the requirements of training for the award of degree of **Computer Science and Engineering (Hons)**, Lovely Professional University, Phagwara.

SURYA

11903382

Date: 31/07/2021

ACKNOWLEDGEMENT

The success and final outcome of this summer training required a lot of guidance and assistance from many people. All that I have done is only due to such supervision and assistance and I would not forget to thank them.

I respect and thank **Mr. Ashok Mittal** for providing me an opportunity to do the **6 weeks summer internship** and giving me all the support and guidance, which made me complete the summer training duty. I am extremely thankful to him for providing such a nice support and guidance.

I owe my deep gratitude to my project trainee **Mr. Gurpreet Singh Shahi**, who took keen interest on my summer training and guided me all along, till the completion of my internship work by providing all the necessary information.

I am thankful and fortunate enough to get constant encouragement, support and guidance from the teaching staff of “**School of Computer Science and Engineering**” which helped me successfully completing my summer internship.

SUMMER INTERNSHIP TRAINING CERTIFICATE

HUMAN RESOURCE DEVELOPMENT CENTER

[Under the Aegis of Lovely Professional University, Jalandhar-Delhi G.T Road, Phagwara (Punjab)]



Certificate No. 227478

Certificate of Participation

This is to certify that **Mr. Surya S/o Sh. Sathyanandam** participated in **Online Certificate Course on Level Game Design in 3D and Augmented Reality using Unity Game Engine** organized by Lovely Professional University w.e.f. **June 07, 2021 to July 16, 2021** (50 hours) and obtained **"O"** Grade.

Date of Issue : 16-07-2021
Place : Phagwara (Punjab), India

Prepared by
(Administrative Officer-Records)

Checked By
Program Coordinator

Head
Human Resource Development Center

Note: The Grades reflected are based on the performance of the participant at the time of training and performance is subject to change subsequently.

Grade Description:

O : 90% and above
A : 75 % to less than 90%
B : 60% to less than 75 %
C : 50% to less than 60%
D : Below 50%

TABLE OF CONTENTS

<u>S.NO</u>	<u>TITLE</u>	<u>PAGE NO</u>
1	Introduction	6
2	Technology Learnt	7
3	Reason For Choosing This Technology.	10
4	Game 1 steps and screenshots.	12
5	Game 2 steps and screenshots	19
6	Learning Outcome from training	22
7	Gantt Chart	23
8	Bibliography	24

INTRODUCTION

Designing a game in unity game engine is always fun. Making a realistic game in 3rd dimension and in augmented reality is really interesting. From my childhood I like playing games. Games which are simpler attracts me more than the high graphic games. To be frank flappy bird is simple 2D game but it is my most favourite game ever. Seriously, I never thought that I would learn develop the same flappy bird game in future.

Basically, before designing a game we need to have two things: one is a latest version of a proper game engine and second basic knowledge about that game engine. There are many game engines in present world but unity game engine is something different. Unity allows us to code in C sharp language and the compiler is really user friendly. I luckily got this game designing course in my second year as a practical course. First, I learnt about the unity technology and the about the tools.

Unity is basically a collection of large number of game tools. Many commercial games are built using the unity game engine. I personally felt very comfortable with unity game engine. At total I have designed two games, one is an adventurous heart collection game in unity 3D and a balloon shooting game in augmented reality. In this report I'll be discussing about the steps, scripts, game screenshots. This report also includes the Gantt chart of my work week wise.

TECHNOLOGY LEARNT

In this 6-week summer training, I've learnt about the **unity technology**. Unity is the World's most popular development platform for creating 2D and 3D multiplatform games and interactive experiences. Unity is a cross-platform game engine developed by Unity Technologies, first announced and released in June 2005 at Apple Inc.'s Worldwide Developers Conference as a Mac OS X-exclusive game engine. The engine has since been gradually extended to support a variety of desktop, mobile, console and virtual reality platforms. It is particularly popular for iOS and Android mobile game development and used for games such as Pokémon Go, Monument Valley, Call of Duty: Mobile, Beat Saber and Cuphead. It is cited to be easy to use for beginner developers and is popular for indie game development.

The engine can be used to create three-dimensional (3D) and two-dimensional (2D) games, as well as interactive simulations and other experiences. The engine has been adopted by industries outside video gaming, such as film, automotive, architecture, engineering and construction.

OVERVIEW

Unity gives users the ability to create games and experiences in both 2D and 3D, and the engine offers a primary scripting API in C#, for both the Unity editor in the form of plugins, and games themselves, as well as drag and drop functionality. Prior to C# being the primary programming language used for the engine, it previously supported Boo, which was removed with the release of Unity 5, and a version of JavaScript called Unity Script, which was deprecated in August 2017, after the release of Unity 2017.1, in favour of C#.

Within 2D games, Unity allows importation of sprites and an advanced 2D world renderer. For 3D games, Unity allows specification of texture compression, mipmaps, and resolution settings for each platform that the game engine supports, and provides support for bump mapping, reflection mapping, parallax mapping, screen space ambient occlusion (SSAO), dynamic shadows using shadow maps, render-to-texture and full-screen post-processing effects.

HISTORY

The Unity game engine launched in 2005, aiming to "democratize" game development by making it accessible to more developers. The next year, Unity was named runner-up in the Best Use of Mac OS X Graphics category in Apple Inc.'s Apple Design Awards. Unity was initially released for Mac OS X, later adding support for Microsoft Windows and Web browsers.

Unity 2.0 launched in 2007 with approximately 50 new features. The release included an optimized terrain engine for detailed 3D environments, real-time dynamic shadows, directional lights and spotlights, video playback, and other features. The release also added features whereby developers could collaborate more easily.

Unity 3.0 launched in September 2010 with features expanding the engine's graphics features for desktop computers and video game consoles. In addition to Android support, Unity 3 featured integration of Illuminate Labs' Beast Lightmap tool, deferred rendering, a built-in tree editor, native font rendering, automatic UV mapping, and audio filters, among other things.

In June 2020, Unity introduced the Mixed and Augmented Reality Studio (MARS), which provides developers with additional functionality for rules-based generation of augmented reality (AR) applications. Unity released Unity Forma, an automotive and retail solution tool, on December 9th, 2020.

SUPPORTED PLATFORMS

Unity is a cross-platform engine. The Unity editor is supported on Windows, macOS, and the Linux platform, while the engine itself currently supports building games for more than 19 different platforms, including mobile, desktop, consoles, and virtual reality. Officially supported platforms as of Unity 2020 LTS are:

- Mobile platforms iOS, Android (Android TV), tvOS;
- Desktop platforms Windows (Universal Windows Platform), Mac, Linux;
- Web platform WebGL;
- Console platforms PlayStation (PS4, PS5), Xbox (Xbox One, Xbox Series X/S), Nintendo Switch, Stadia;
- Virtual/Extended reality platforms Oculus, PlayStation VR, Google's ARCore, Apple's ARKit, Windows Mixed Reality (HoloLens), Magic Leap, and via Unity XR SDK Steam VR, Google Cardboard

UNITY ASSET STORE

Creators can develop and sell user-generated assets to other game makers via the Unity Asset Store. This includes 3D and 2D assets and environments for developers to buy and sell. Unity Asset Store launched in 2010. By 2018, there had been approximately 40 million downloads through the digital store.

REASON FOR CHOOSING THIS TECHNOLOGY

- The engine works with C# but you can also use many languages, such as C++, Python, Java in form of libraries, and is compatible with various operating systems (Windows, Linux) and devices (such as Chromebook, Mac). So, we basically programming in C#, it is easy to find solutions to problems, not only within Unity resources but also in the documentation and articles related to the language itself. Besides, thanks to Garbage Collector in C#, we don't have to worry about engine memory leaks.
- Unity is a very well-made engine that works perfectly on both iOS and Android.
- Due to its approach to objects and built-in classes Unity works great for rapid prototyping of applications and games It is especially important for AR / VR applications developments where we can practically test the concept of some functionality on the device right away.
- Easy debugging (especially when it comes to logic and UI, e.g., rendering threads) is another advantage of Unity over other engines such as Godot, Unreal. A great tool for assessing the status and optimization of your application is the built-in Profiler, which allows finding bottlenecks.
- Despite the unstructured UI, the engine has well-resolved UI responsiveness. It allows us to define the arrangement, scaling and behaviour of containers from the editor level easily (e.g. stretching to the size of the window).

- Unity is a multi-platform environment and works great for creating cross-platform AR/VR applications, mobile games, console games, due to the possibility to create 3D graphics with a relatively small amount of work in a very easy way without extensive programming knowledge needed. This is not a case when programming in Android Studio for instance.
- The resources available in the ML-Agents module reduce the barriers faced by the developers of machine learning applications.
- It might look like Unity is not the best tool for creating mobile applications and it is a rather common opinion. However, more and more game studios use the Unity engine, as well as offer job positions for Unity engineers.
- The reasons for that among others are: the dynamically developing Unity has a low entry threshold; it has a large pool of free learning assets and quite pleasant documentation.
- Overall, Unity is a good and convenient tool with a very low entry-level. It is accompanied by a lot of well-described tutorials and its own learning platform.

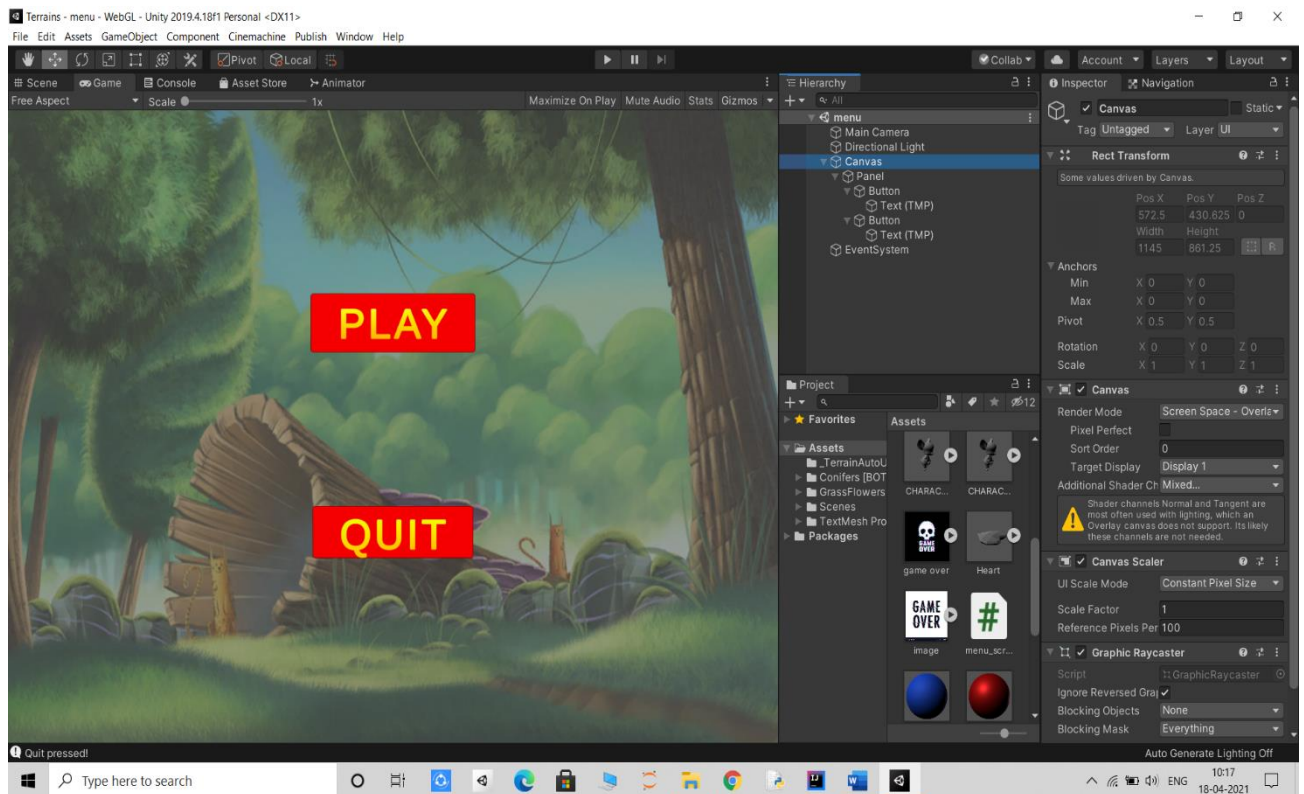
GAME 1

ADVENTUROUS HEART COLLECTION GAME IN UNITY 3D

REQUIRED STEPS: -

SCENE-1

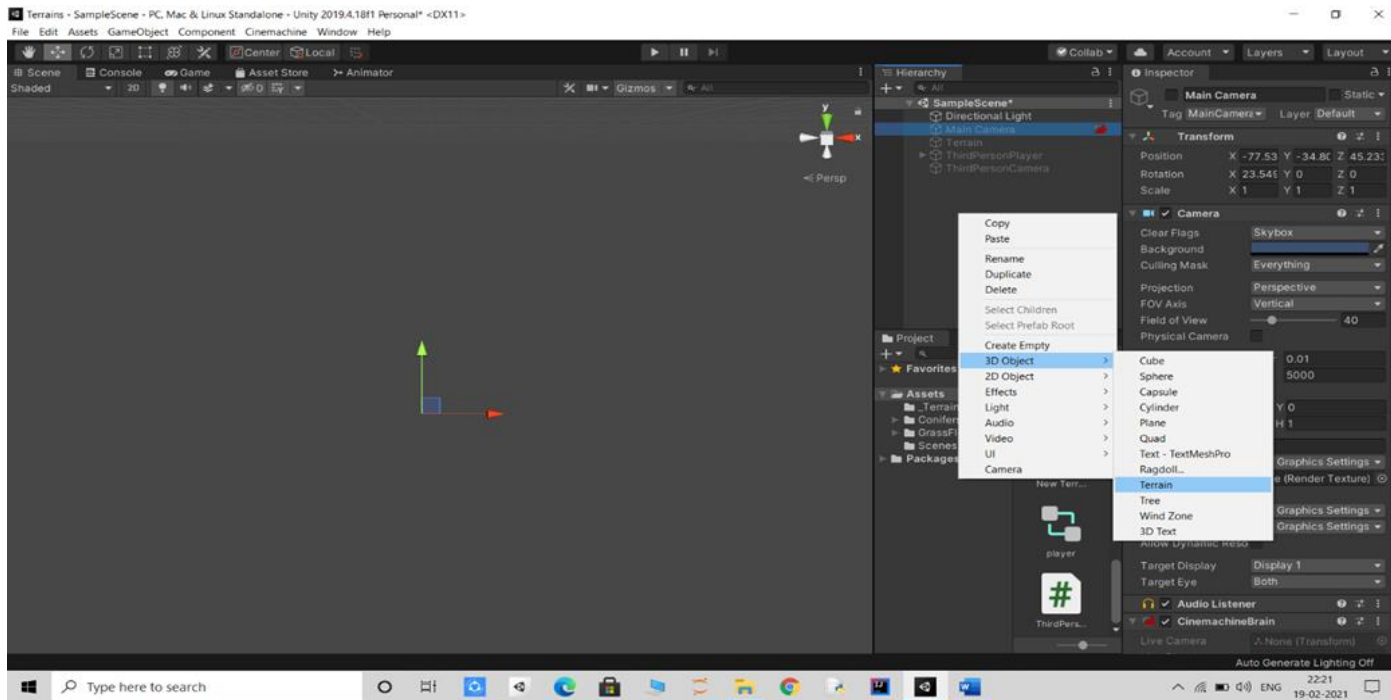
- 1) Create a menu interface with two buttons into it i.e., play and quit.
- 2) For buttons and text (TMP), you can use canvas (panel). Add a background image to menu of “.png” format.



- 3) By pressing play button, you can enter into play mode which is nothing but scene2.

SCENE-2

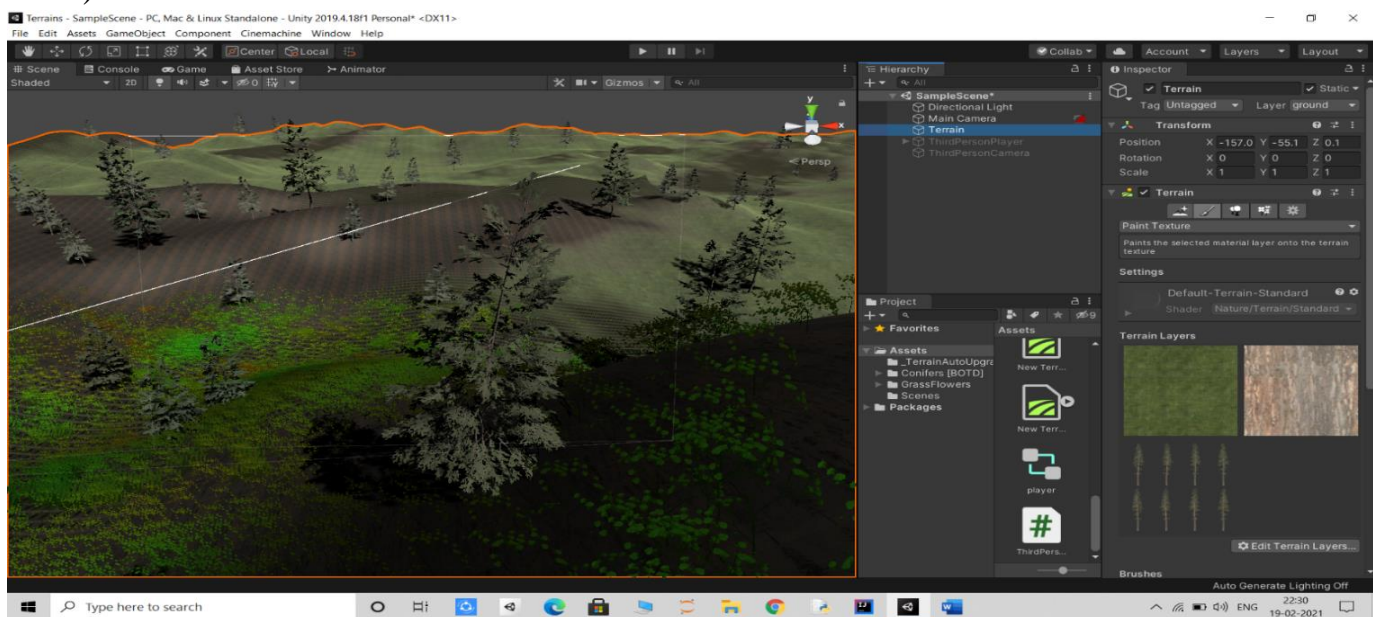
1) Create a terrain in hierarchy window by right clicking it.



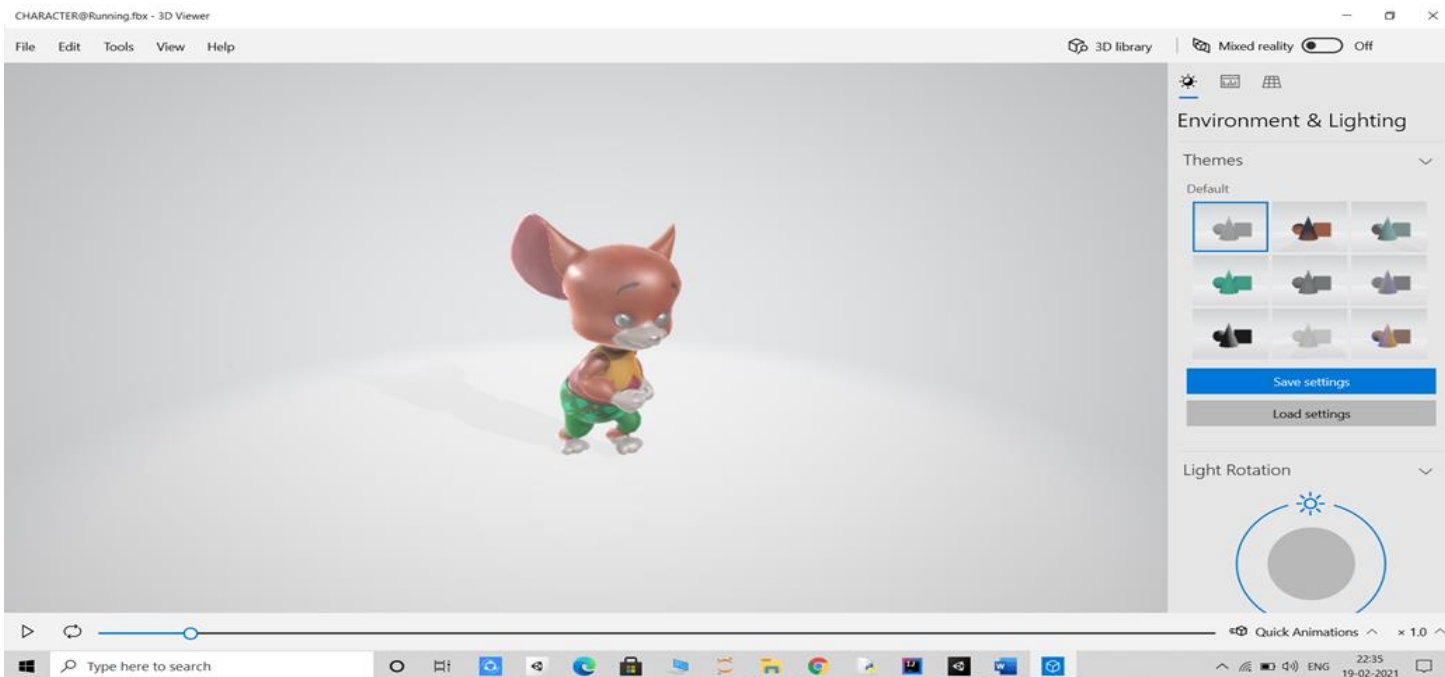
2) Then by selecting “paint terrain” and then “raise the lower terrain” model your terrain.

3) Now apply the grass textures to the terrain by importing a grass asset from unity store.

4) Now add tress to look more realistic like a terrain.

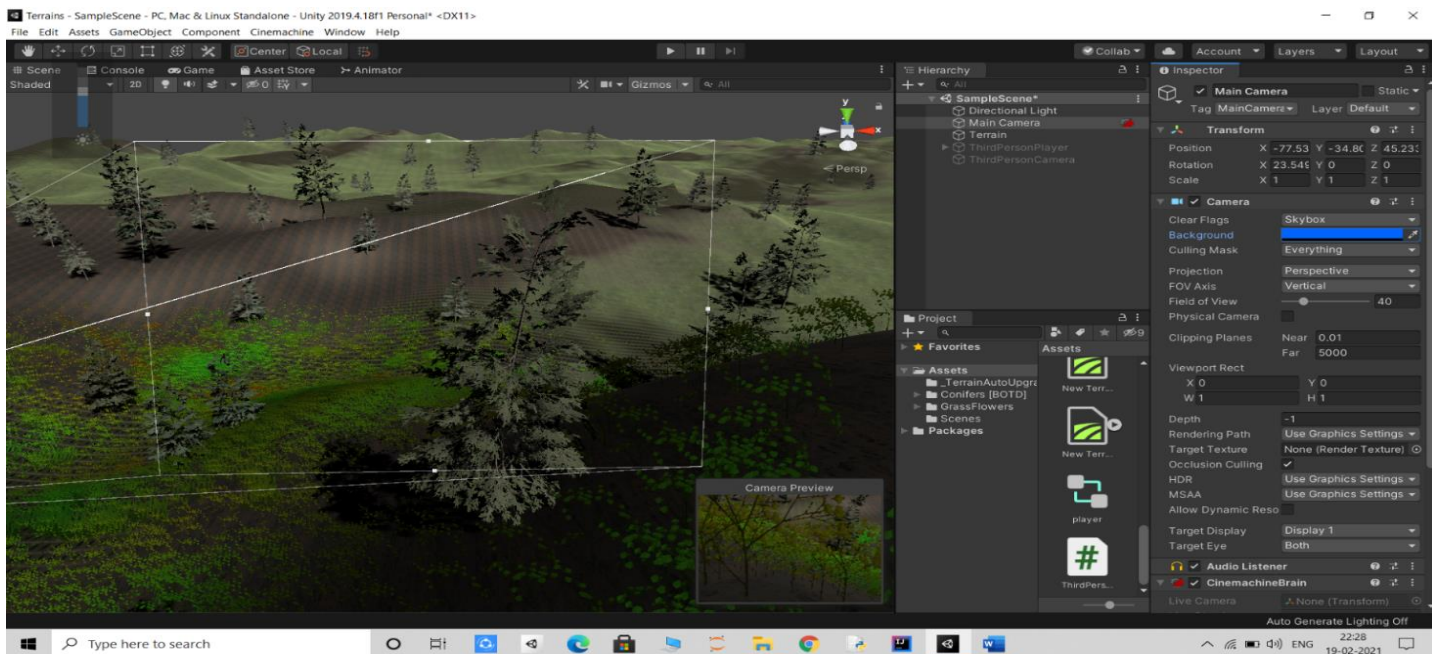


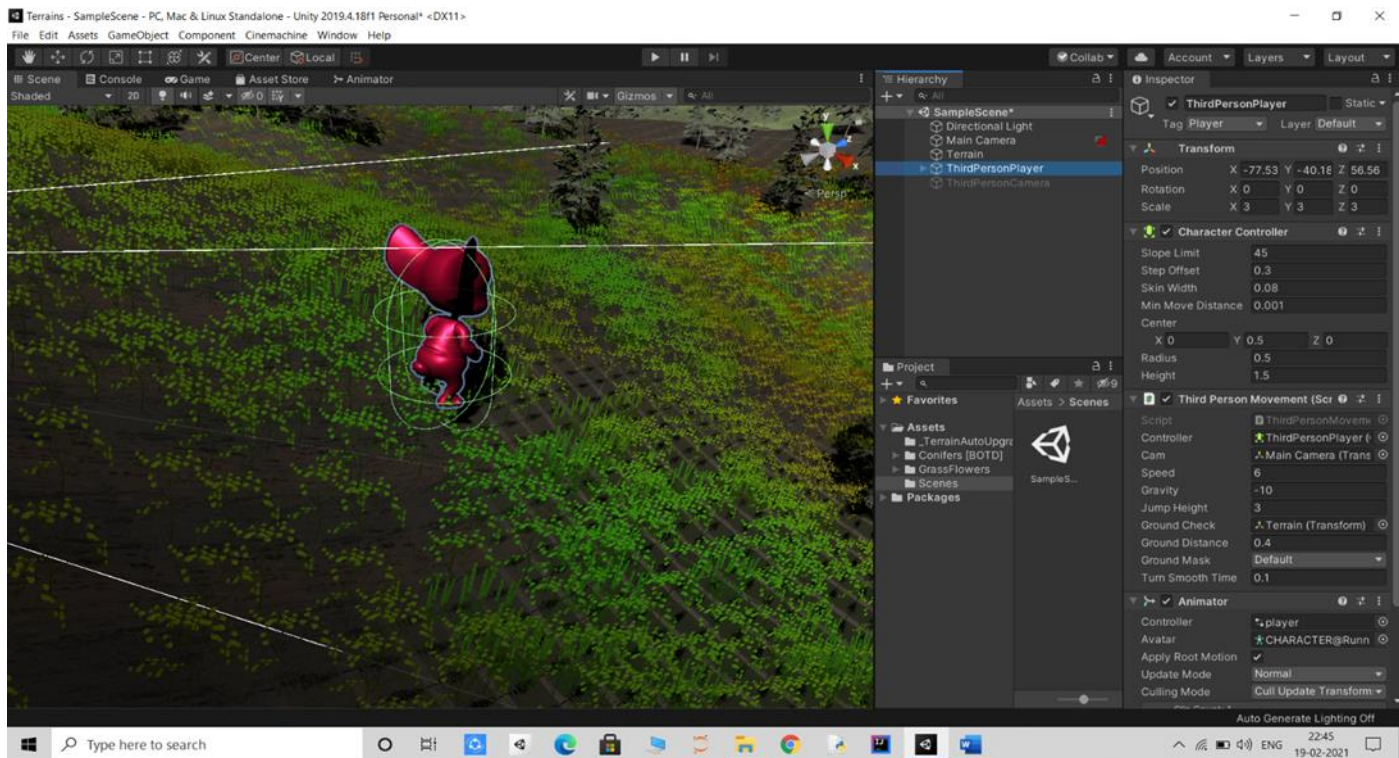
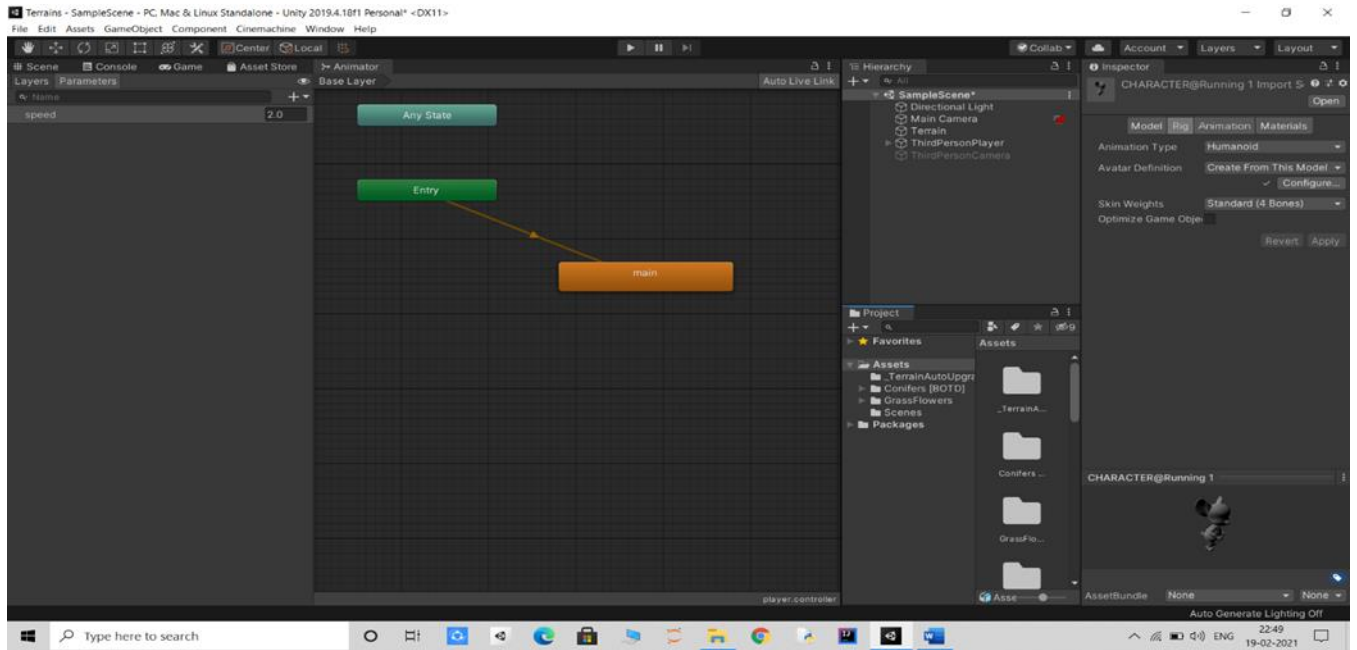
- 5) Now terrain is completed. Go to “www.mixamo.com” website and download your required character.



- 6) Import the above character into the project window and then add some animations to the characters so that it runs properly.

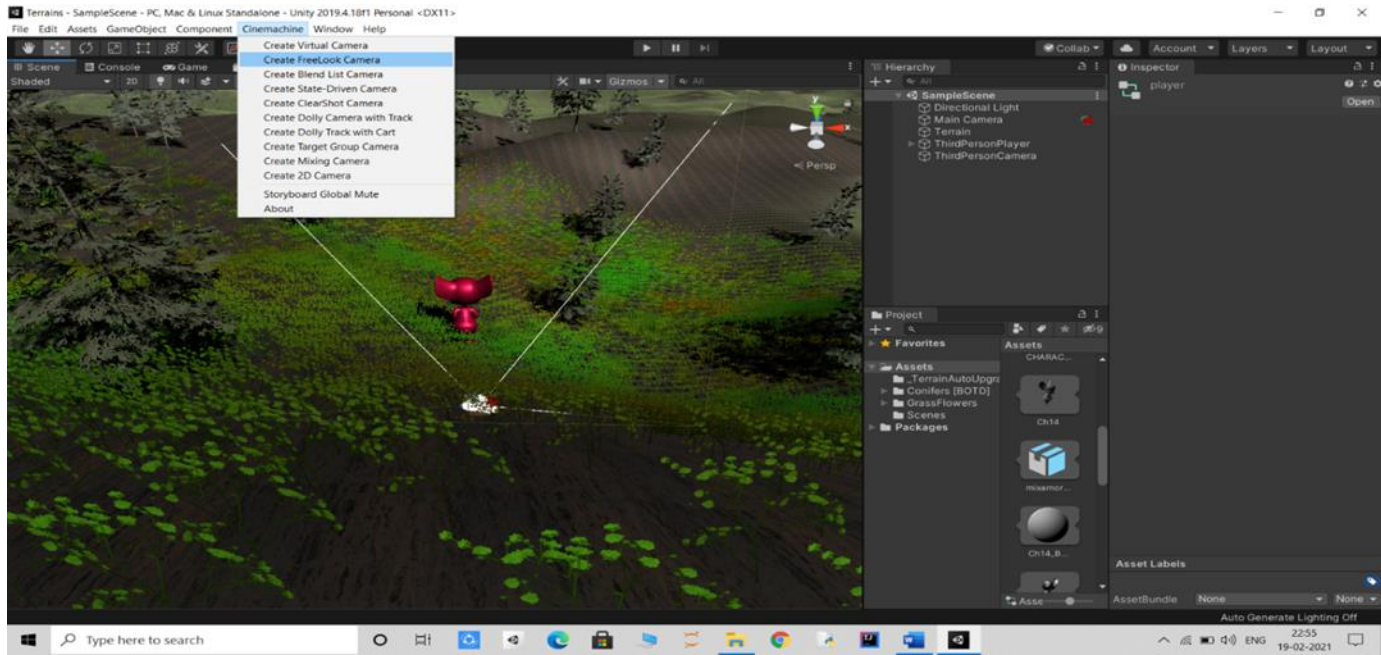
- 7) In order to animate, add component animator and change the necessary properties. Also, change the colour material of the character to red.





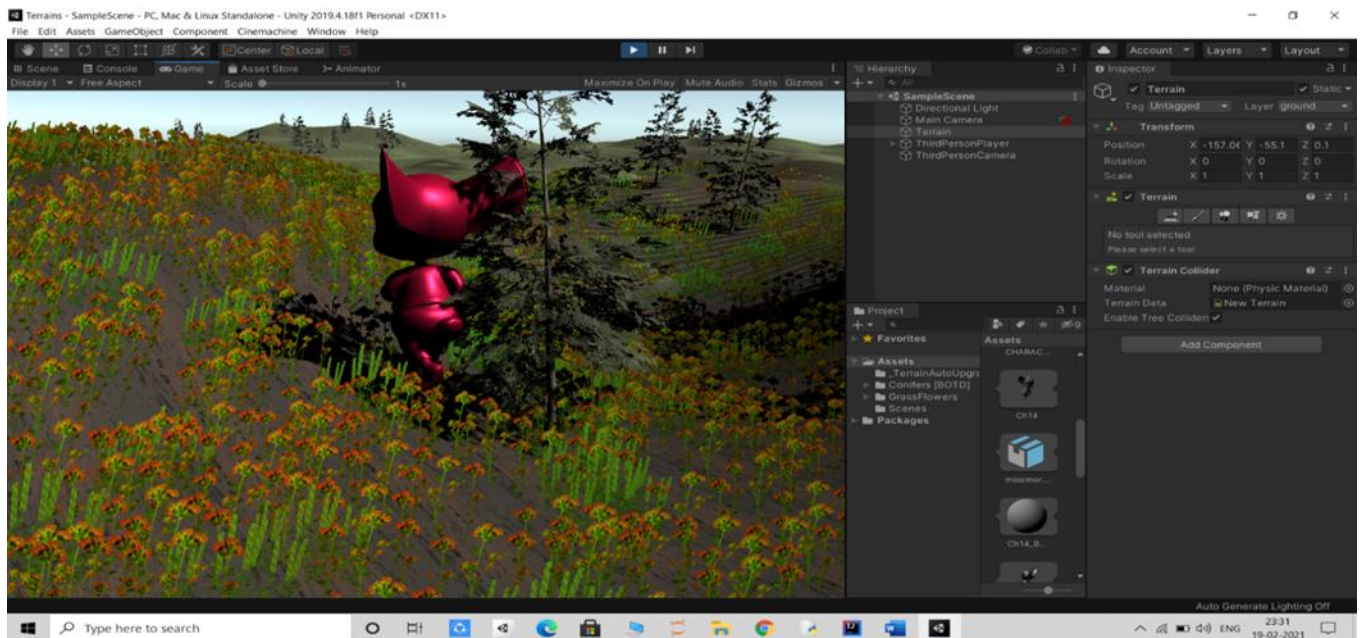
8) Import the player and drag its prefab to scene.

9) After that go to windows -> package manager and install cinemachine for smooth camera follow.



10) Select the character and script it to third person player.

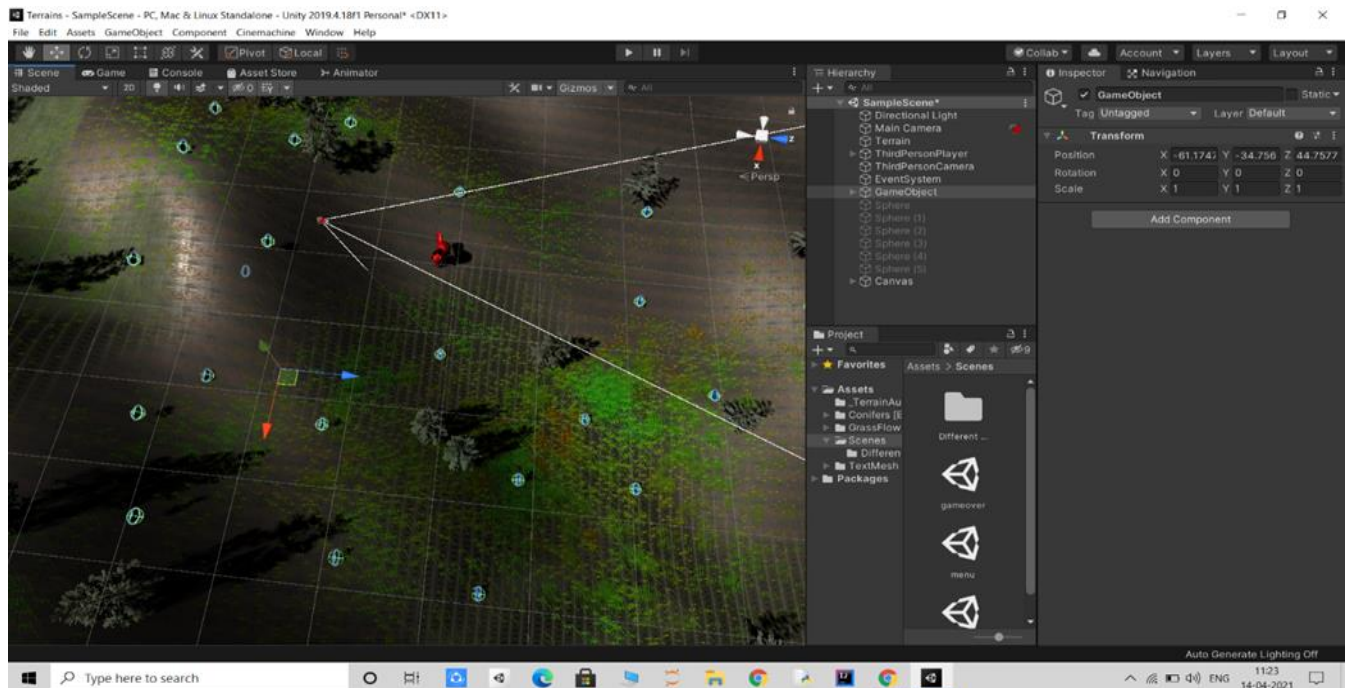
11) Open the script in notepad and write the code for movement, gravity, speed and jump.



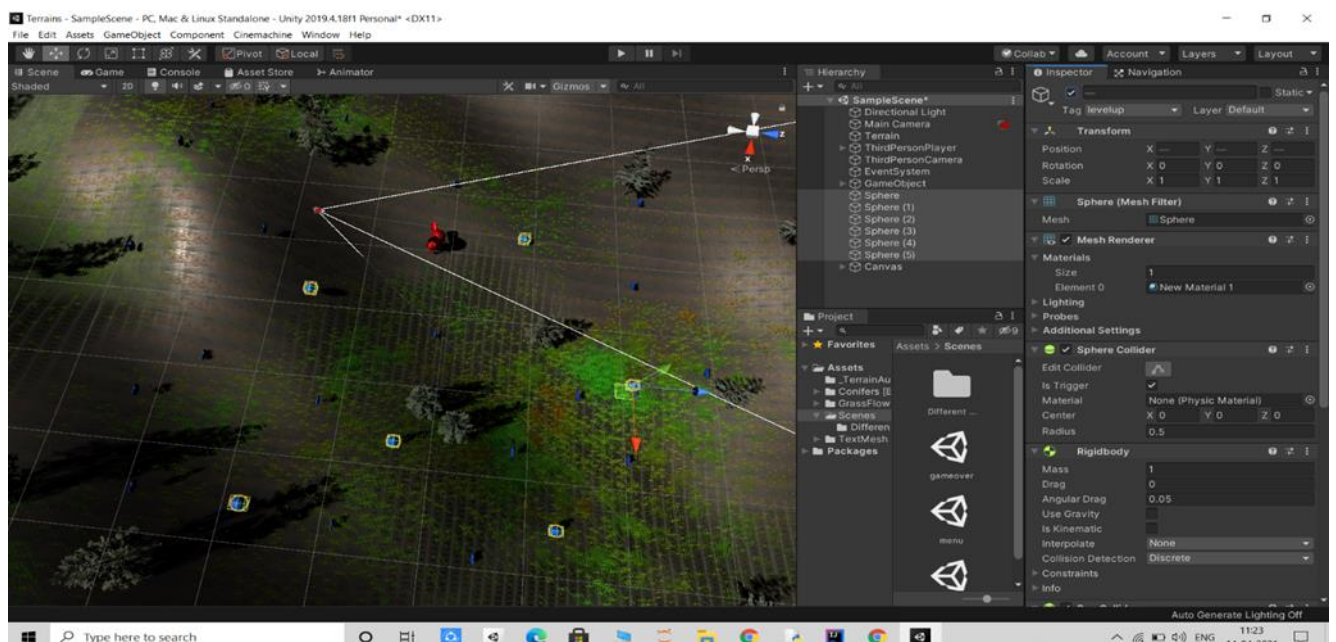
12) Add the above script to the third person player. Then add a score text into the game window.

13) Now add few hearts into the scene window and add animation script and capsule collider to the hearts.

14) Create an empty and rename it to game object and put all the hearts into it.



15) Score increases when you collect the stars. In order to end the game, I've placed few spheres.

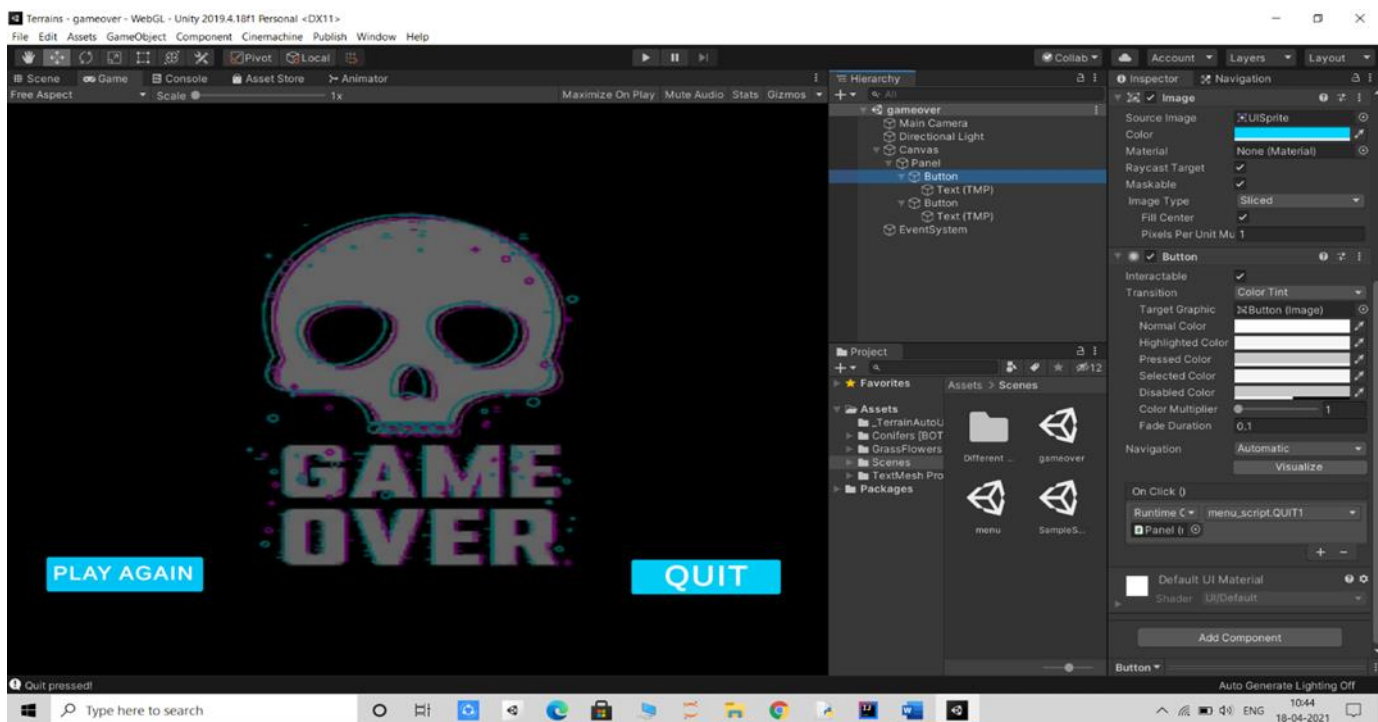


16) When you touch the sphere instead of the hearts, your scene2 quits and game over scene appears(scene3).

17) Add the pick-up script to third person player.

SCENE-3

- 1) Design a menu with game over image downloaded from internet as a background image.
- 2) Add two buttons play again and quit. Create a panel add the menu script to the buttons.



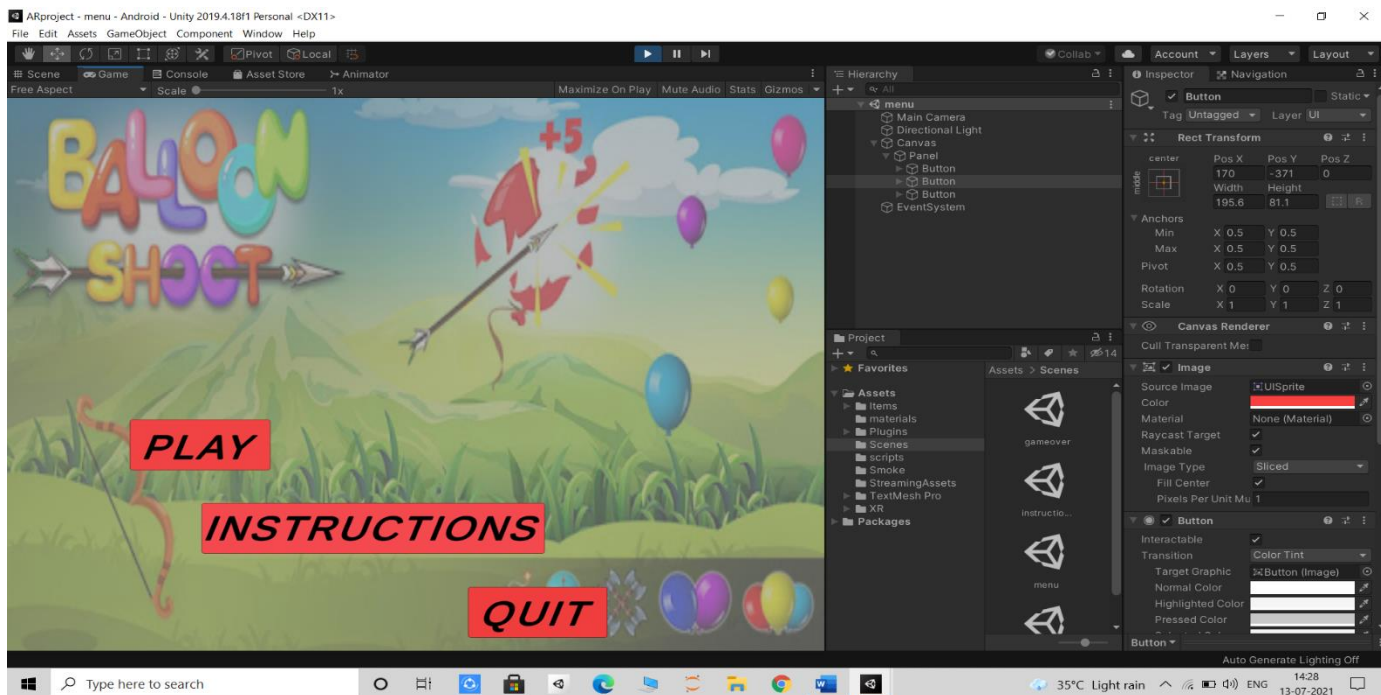
- 3) Link scene1 and scene 2 to the quit and play again buttons.

/ END OF GAME 1 **/**

GAME-2

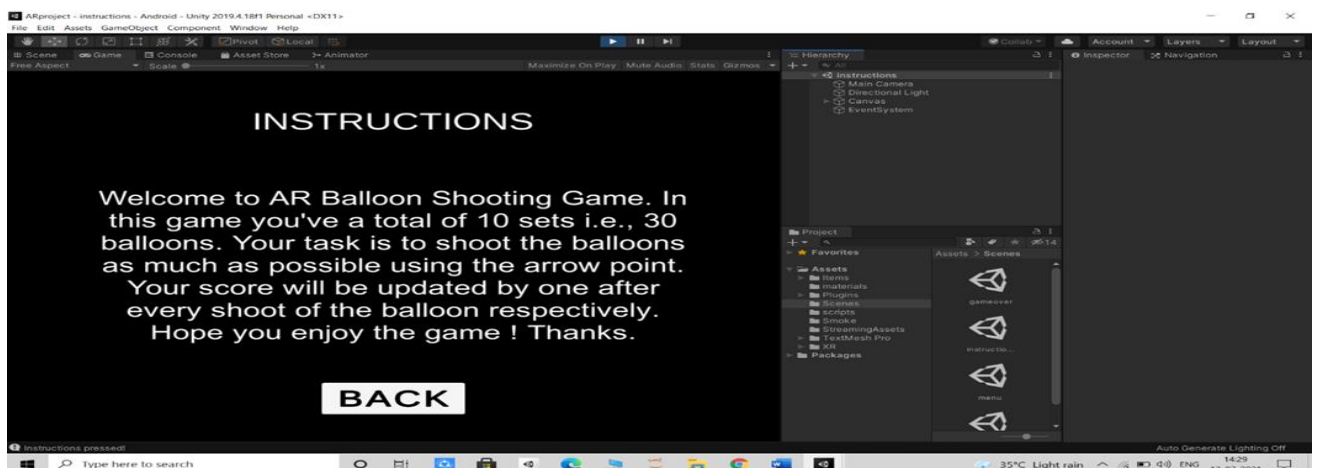
BALLOON SHOOTING GAME IN AUGMENTED REALITY

REQUIRED STEPS: -



1) Create a panel in hierarchy window and add an image in the background using .png extension.

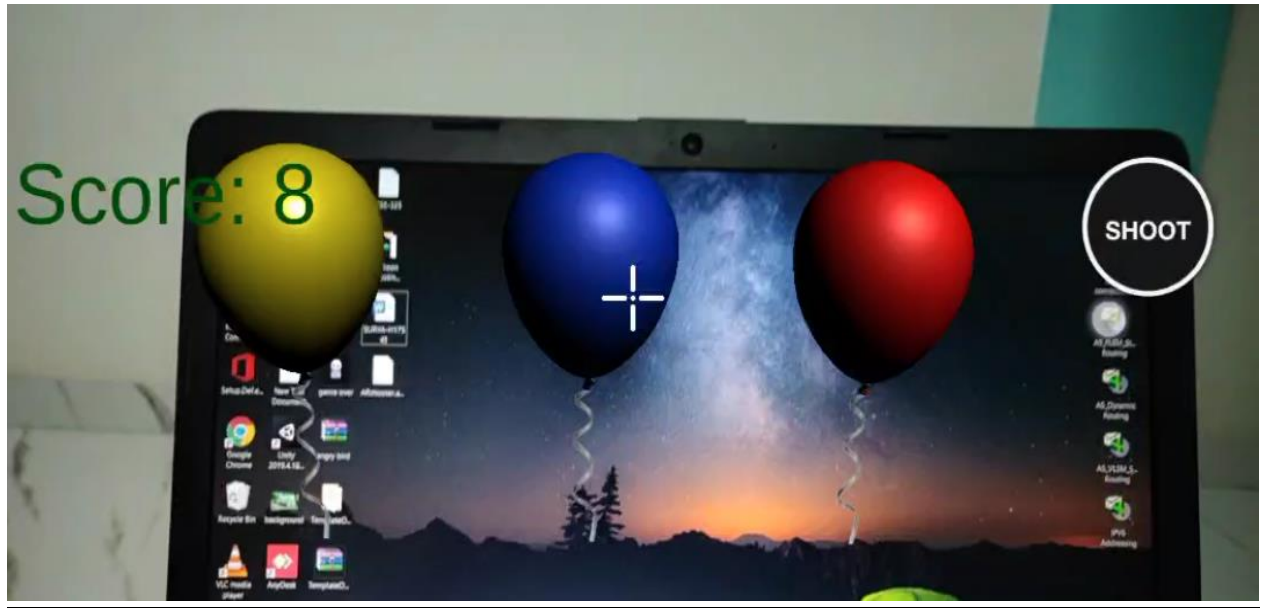
2) Add three buttons Play, instructions, quit to menu.



3) When you press instructions button, you'll be taken to a new scene called instructions scene (**SCENE-2**).

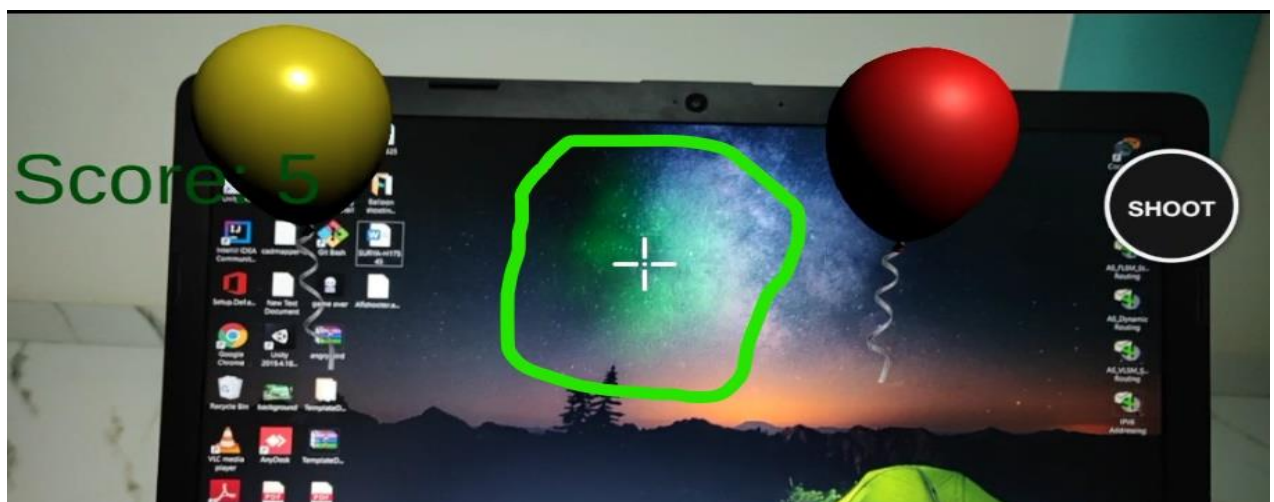
4) In this scene you'll have a detailed information about the game.

SCENE-3



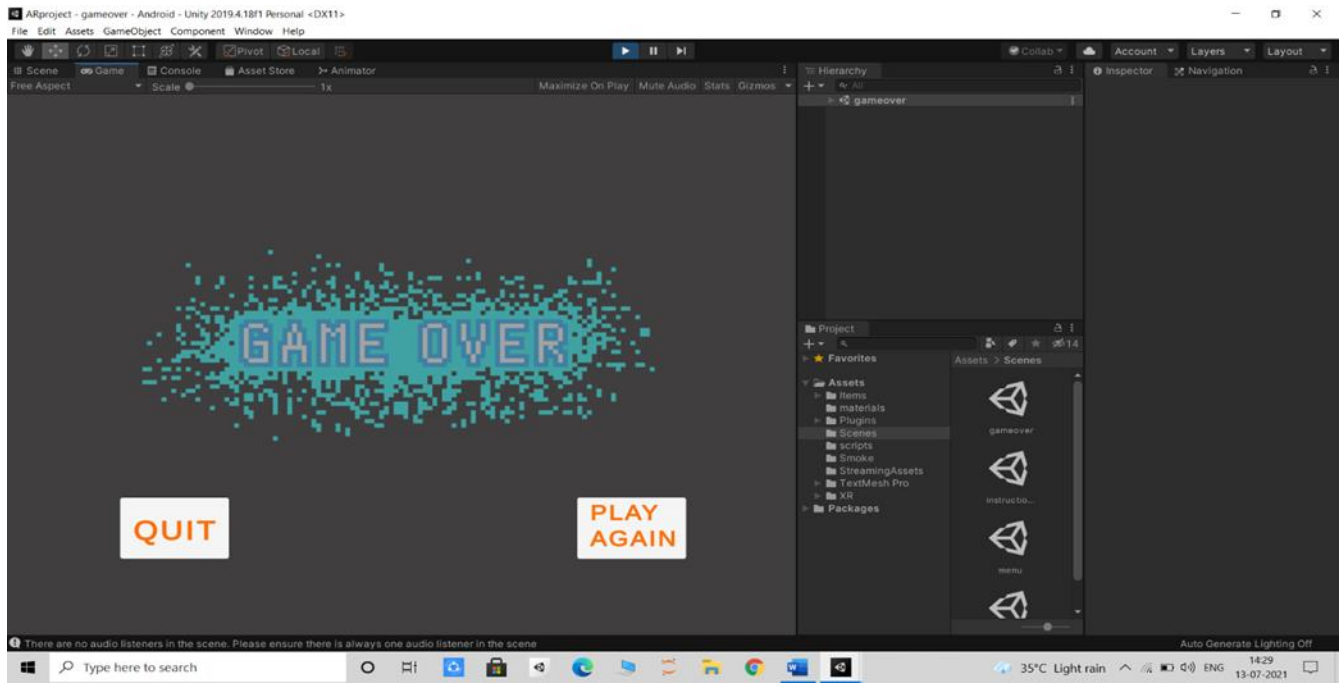
5) When you press play button the above scene appears. In this scene you'll have realistic AR background with shoot and score text.

6) At total you'll have 10 sets of balloons with different colours. Your task is to shoot the balloon with the help of arrow. This process is done using ray cast (bool variable).



7) As you can see above, when you shoot the balloon, your balloon will get destroyed and a green colour smoke effect has been added. Also, you'll score will get updated by one.

SCENE-4



8) After 10 sets you will be taken to the gameover scene.

9) In this scene I've added a gameover background image with two buttons i.e., play again and quit.

10) When you press play again, you'll be taken to scene-3 and if you press quit, you'll be taken to scene-1. I've done this using the build levels in build settings.



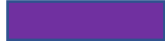


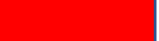

/ END OF GAME 2 **/**

LEARNING OUTCOME FROM THE TRAINING

I've learnt many things in this 6 weeks training. Those are:

- ❖ How to download and install the latest version of unity engine with necessary packages.
- ❖ Unity Scenes and the layout of the Unity interface.
- ❖ Game Manager Physics and colliders.
- ❖ Terrain design in unity and Rotation, Scaling and Input handling of terrain.
- ❖ Prefabs in unity and probuilder tool in unity.
- ❖ C# language concepts.
- ❖ Creating scripts with functions.
- ❖ First Person Controller and third person controller.
- ❖ Adding text in the game.
- ❖ Character introduction the game scene.
- ❖ Code the movement of character.
- ❖ Introduction to AR and VR.
- ❖ Installation of Vuforia engine with mobile and PC support.
- ❖ Capturing image and creation of vuforia database.
- ❖ Projecting 3D model on Image target.
- ❖ Marked and Markerless Augmented reality.
- ❖ Add controls to the object in AR.
- ❖ Creating AR book app.
- ❖ Multitarget detection.

GANTT CHART

TASK COVERED	WEEK-1	WEEK-2	WEEK-3	WEEK-4	WEEK-5	WEEK-6
INTRODUCTION TO UNITY 3D						
INSTALLATION OF UNITY ENGINE						
LAYOUT OF INTERFACE						
SPRITES IN UNITY						
ASSET STORE IN UNITY						
Rigidbody, COLLIDERS						
ANIMATIONS						
PREFABS						
LIGHTENING EFFECTS						
ROTATION, SCALING						
C# LANGUAGE CONCEPTS						
CREATING SCRIPTS						
GAMING LOOP						
C# FUNDAMENTALS						
CODE THE CHARACTER						
LEVEL DESIGNS OF GAME						
INTRODUCTION TO THE ENVIRONMENT						
TERRAIN DESIGN						
PROBUILDER						
1 ST AND 3 RD PERSON						
INSTALLATION OF VUFORIA ENGINE						
CREATING AR APP						
MARKED AND MARKERLESS AR						
TEXT, OBJECTS WITH AR						

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- 1) <https://www.mixamo.com/#/>
- 2) [https://en.wikipedia.org/wiki/Unity_\(game_engine\)](https://en.wikipedia.org/wiki/Unity_(game_engine))
- 3) https://www.youtube.com/watch?v=_yf5vzZ2sYE
- 4) <https://www.youtube.com/watch?v=aFArhpJB86s>
- 5) <https://www.youtube.com/watch?v=vApG8aYD5aI>
- 6) <https://www.youtube.com/watch?v=Feoqa9Ge-a8>