HOCHSCHULE SCHMALKALDEN

UNIVERSITY OF APPLIED SCIENCES

AR ALIENS SHOOTING GAME

Project work on "Virtual and Augmented Environments" - Winter Term 2023-24

Submitted by

Brijesh Rajendra Yadav (313945)

Under the guidance of

Prof. Hartmut Seichter, PhD

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ABOUT PROJECT

a. The project is part of our curriculum. it is based on Augmented Reality
b. I have used Unity 3D Game Engine and ARCore SDK to achieve the project.

I am attaching the .zip file which consists of

1. Unity project Files
2. Glimpse of Games
    i. Screenshot of the game
    ii. A recorded video of gameplay visualizing the functionality using built-in device record for Android phone

GOAL DESCRIPTION

- The project's main goal is to create an augmented reality game that connects the real and virtual worlds and teaches different technologies.
- Users can interact in the real world using different device sensors such as cameras etc.

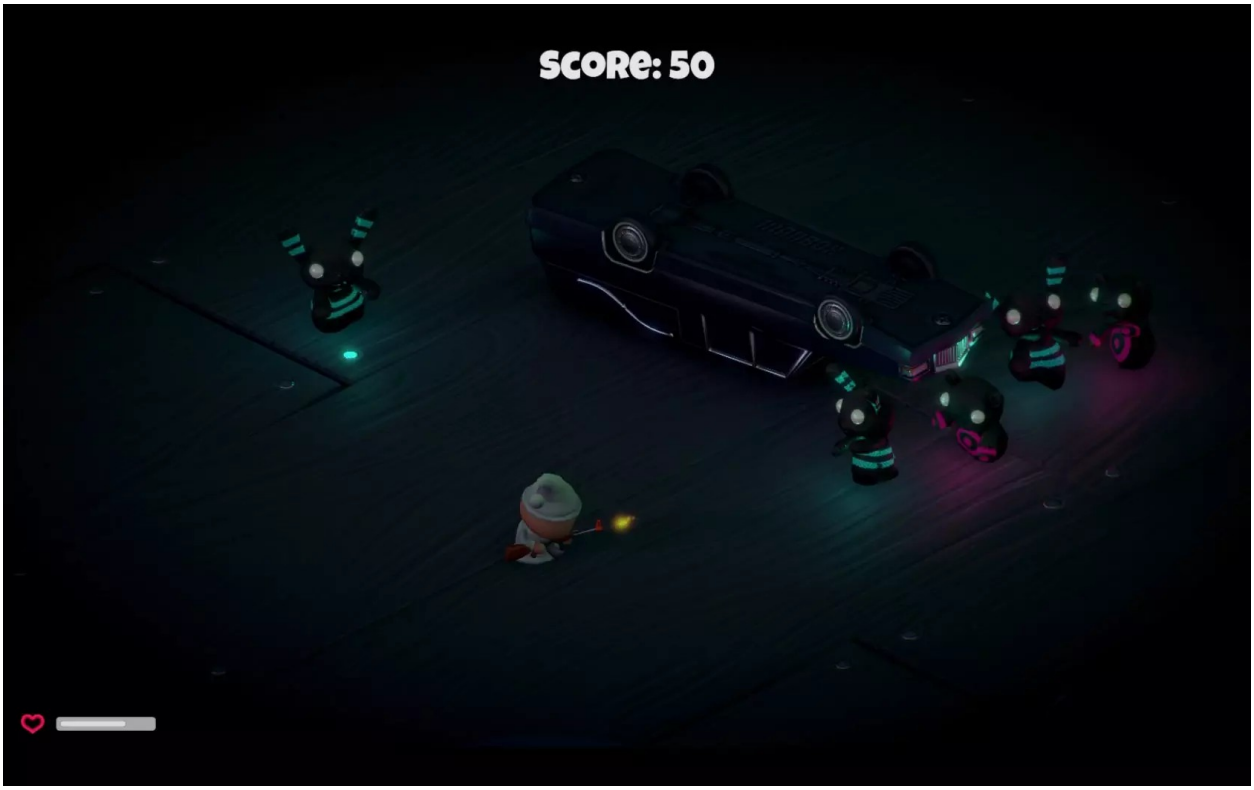
THEORETICAL FOUNDATIONS

- AR Technology has always been fascinating since it blends the visual world and the real world.
- in recent years AR Technology has come back with devices such as **“Apple Vision Pro”**, **“Meta Quest 3”** etc. it allows users to perform spatial computing using sensors such as cameras, 3D Sensors, depth sensors, etc.
- The project is a game **“AR Shooting Game”** which blends the real world and digital world (3D objects) and allows them to interact with users.
- Since there are different tracking methods in Augmented Reality. in our project I have used **“Image tracking”** It uses different 2d textures (JPG Images) to find the target in the real world and track it. “image tracking” requires a target but it faster and better than “**Plane Tracking”** which doesn't require any targets.
- the fundamental framework for this project is comprised of all the concepts addressed by Prof. Hartmut Schiecter” in Computer Graphics and **“The Virtual and Augmented Reality”** course.

INSPIRATION

- This Game is based on **“Survival Shooter Tutorial [LEGACY]”** a 3D Shooter game available on Unity Store.

Survival Shooter Tutorial [LEGACY]



PROJECT MILESTONES:

Initiation

- in this phase, different AR Packages such as Vuforia and XROpnesouce Plugins were evaluated to select the foundation for building this application.
- the compatibility and being open source were key points while selecting the XROpensource for unity.

Planning

- in the initial phases of tracking "**Plane Manager**" was used but after discussion and evaluation **"Image-Based Tracking"** was used to provide better performance and tracking.
- to make the game more interactive High Score Feature is added to the game.

Execution

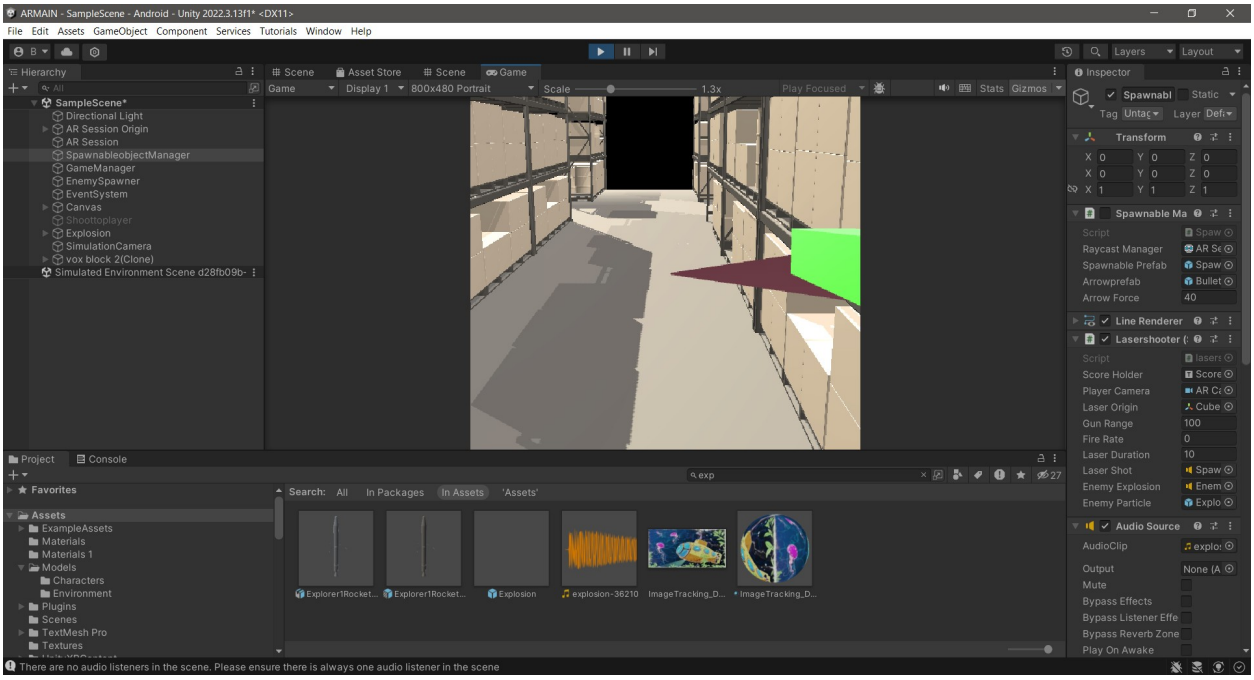
Phase 1

- Phase 1 was used to prototype different game mechanisms and research.
- installing the XR Plugin and implementing the **"Plane"** based tracking. AR Session and AR session origin contain elements such as **"AR Input Manager"** and AR camera to provide a view of the real world to the device.
- Once the plane is detected game manager starts the game.
- Prototyping of shooting system using basic 3d objects such as **"sphere"** the initial shooting system.
    - using the user location on the touchscreen a Ray cast is shot in the scene, if the Ray cast is hit a Bullet Prefab is spawned which has a Rigidboy component by adding force in the Z direction the Bullet Moves in the forward direction.
- to detect if the Bullet has hit an enemy object a sphere collider is used.

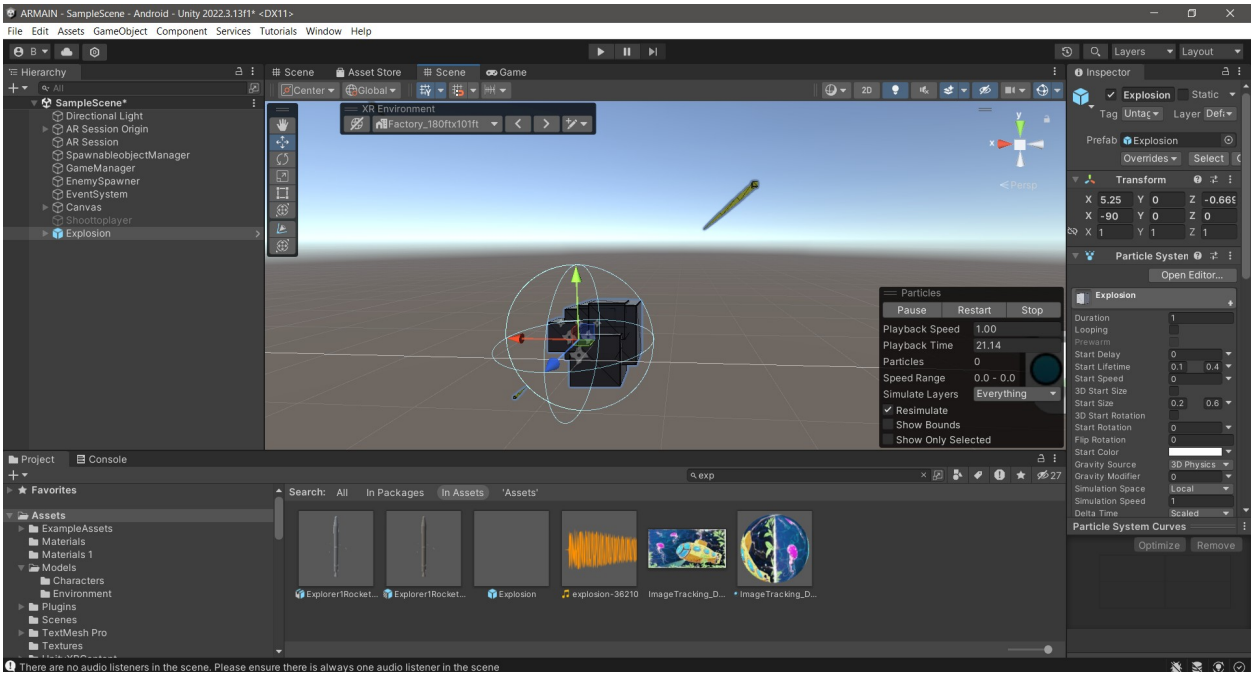
Phase 2

- Phase 2 includes improvement in the already developed features.
- After the initial Presentation, a discussion was done with "**Prof. Hartmut Seichter, PHD"** to improve the tracking and performance an **"Image-based "** Tracker was chosen.
- to implement the "Image-based" Tracker a target image from https://developer-content-images.magicleap.com

- Image image-based tracker requires a **“Reference Image Library”** to provide a set of target images. There can be more than one, a developer can **“specify Size”** and **“keep Texture at Run time”** Properties depending on the use case.
- once the image target is detected the GameManager Starts the Game.
- The initial Shooting System had issues and it didn't provide a better user experience. To improve this a **“Line Render”** based Laser Shooting System is implemented in the current application. using the current Shooting a ray is shot into the system. The laser has a property “Gun Range” which decides how far the laser can travel in any of 3 AXIS (X, Y, Z).
- The Lase Gun also has properties such as **“Fire Rate”** and **“Laser Duration”** to provide more control.
- The Current shooting system doesn't instantiate any 3d objects in the system which provides better performance by reducing memory usage.
- to create a blast effect when the Ray Cast hits an enemy a voxel-based particle created in unity. the particle system instantiated at the position where the ray cast hits the enemy by taking the **hit.position** parameter. enemies contain box collider component to provide this functionality



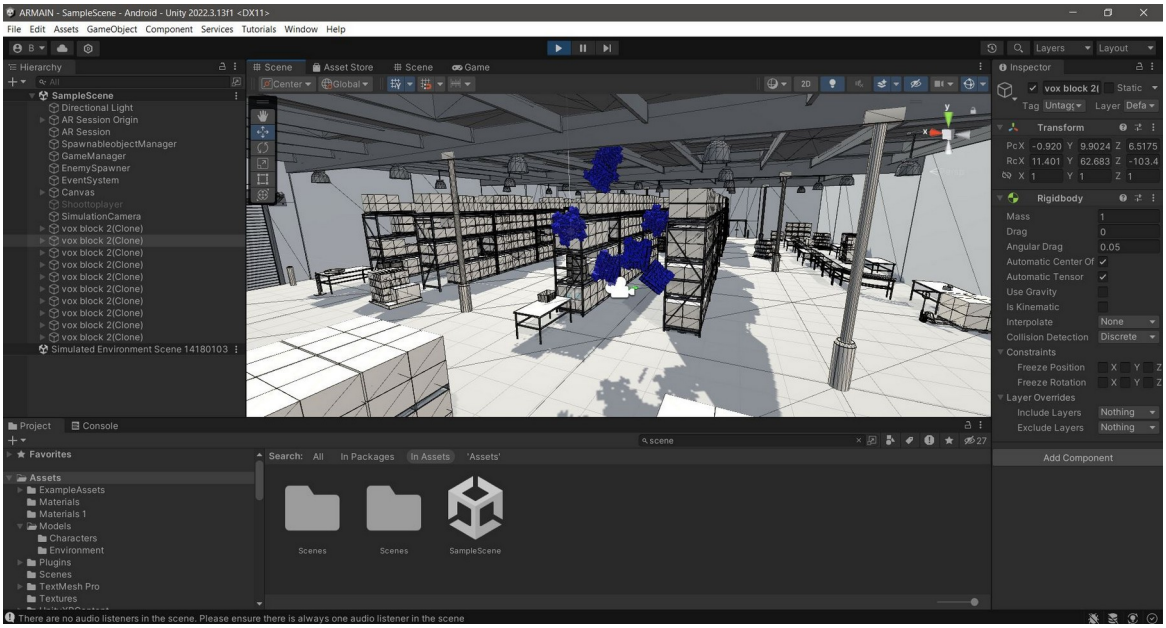
Laser Shooting Functionality



Explosion Particle System

Phase 3

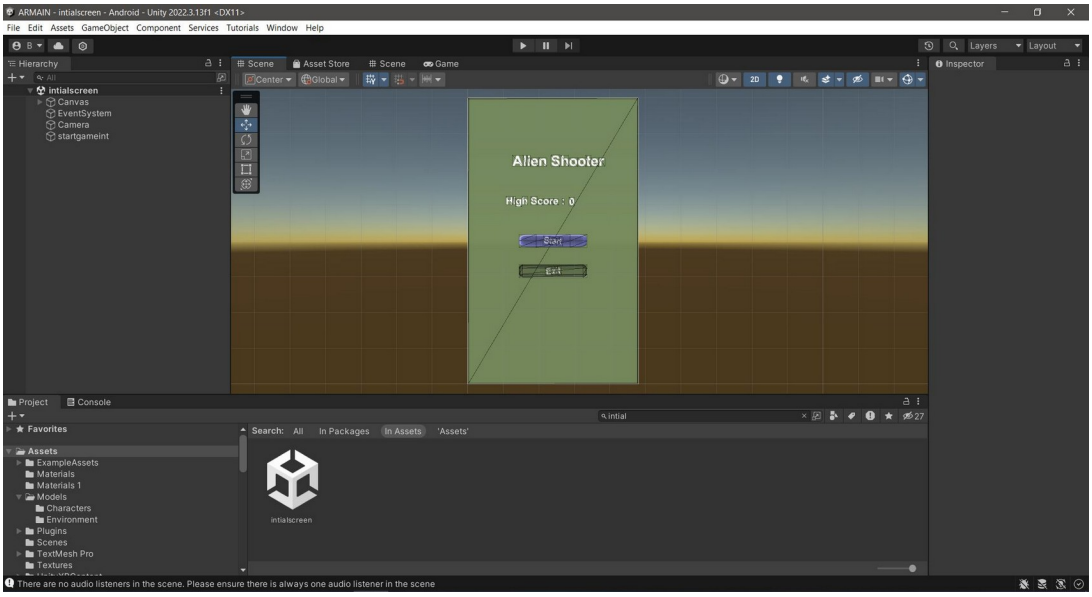
- Phase 3 implemented enemies and sub-interactions in the game.
- to create a 3d model was downloaded from https://itch.io/ it contains a server voxel 3d model for enemies.
- to spawn enemies from different locations a script is used which spawns enemies in a certain radius in a random location.
- to follow the **“Player”** in-game script contains the logic to implement this it keeps the reference of the player's position. The enemy object has variables such as “**Enemy speed**”, **“Spawn Interval”** and **“Spwan Radius”** to control the Spawn of enemies in-game which can be used to increase the difficulty of games by generating more enemies in short intervals.



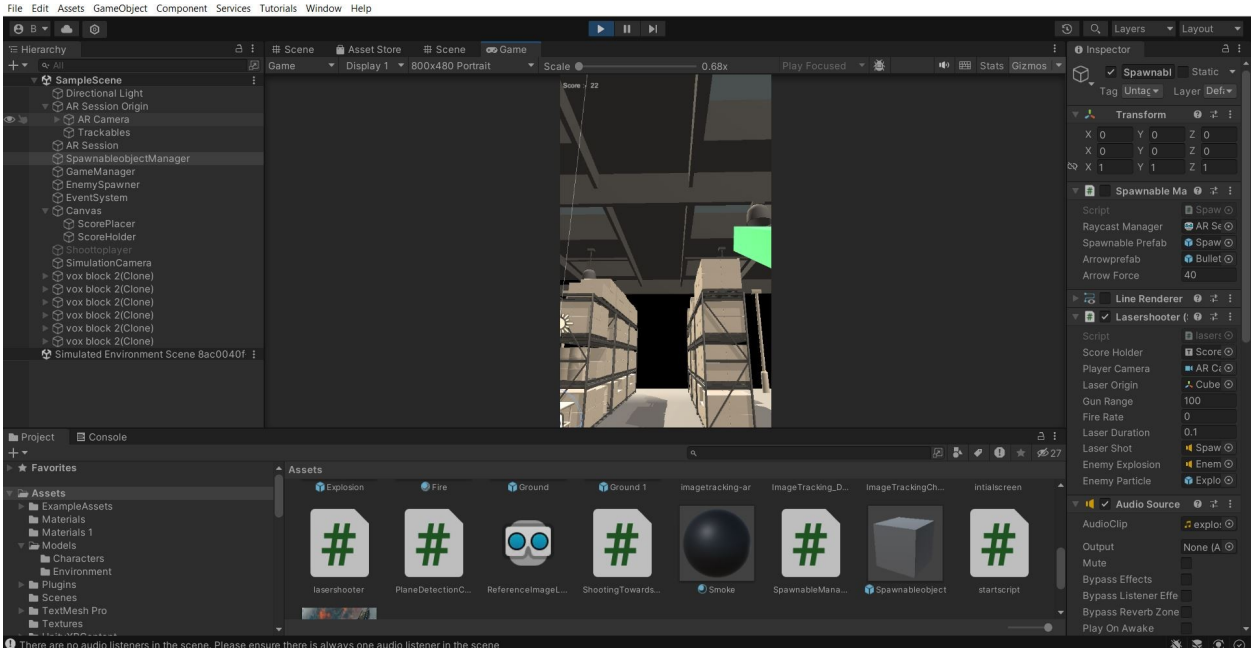
Enemy Instantiation

Phase 4

- Phase 4 contains the UI Development of the game. I have used the Unity GUI System which contains buttons, text, and other components.
- when the user opens the game initially he sees the “initial scene” which allows the user to open and exit the game.
- the **“High Score”** text shows the last High score by the user, to store the user score it uses **“PlayerPrefs”** which stores the high score in the user's device memory. it is not the most secure way to store game data.
- to show the user's current score in the game **“score”** text is used, at the start it reset to 0 as the user kills more enemies the score is incremented by 1.



initial Game Screen



GamePlay with Score

DECLARATION:

• I hereby declare that the project work is based on the work, carried out during our study.

• I did not provide any resources for this project other than what is covered in our Computer Graphics and Virtual and Augmented

LIST OF RESOURCES:

- Reference tutorials for:
    - Unity Reference Tutorial - https://docs.unity3d.com/ScriptReference/
    - Shooting Laser using Raycast and LineRenderer | Unity Game Engine - Shooting Laser using Raycast and LineRenderer | Unity Game Engine
    - EZ EXPLOSIONS | UNITY TUTORIAL - EZ EXPLOSIONS | UNITY TUTORIAL
- Voxel Enemies - https://itch.io/
- Target Image - https://developer-content-images.magicleap.com
- Sounds
    - Shooting Laser Sound - https://cdn.pixabay.com/download/audio/2022/03/15/audio_2c30d5d42e.mp3?filename=laser-gun-81720.mp3
    - Explosion Sound - https://cdn.pixabay.com/download/audio/2022/03/10/audio_f180bb8ad1.mp3?filename=explosion-36210.mp3