

AR Fighter

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

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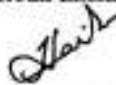
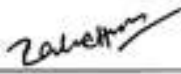
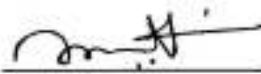
DHAKA, BANGLADESH

15th September 2018

APPROVAL

This Project titled "**AR Fighter**", submitted by Kuldeep Sarker Joy, ID No: 142-15-3632, Md. Bin Yeamin, ID No: 143-15-4398 and Syed Mahmud Hasan, ID No: 143-15-4528 to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the wants for the degree of B.Sc. in Computer Science and Engineering and approved on its style and contents. The presentation has been held on 15th September 2018.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Soumik Das Bibon, Lecturer**, 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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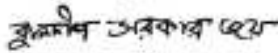
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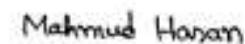


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ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project/internship successfully.

We really grateful and wish our profound our indebtedness to **Soumik Das Bibon, Lecturer**, Department of CSE, Daffodil International University, Dhaka. Deep Knowledge and keen interest of our supervisor in the field of “*Game Developing*” to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to **Dr. Syed Akhter Hossain, Head, Department of CSE**, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

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

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

ABSTRACT

Augmented Reality (Augmented Reality, alluded to as AR for short) is one of the examination hotspots of numerous prestigious outside colleges and research foundations as of late. This is the new technology of the future. So, we made our project in AR platform. The project is on a game called “AR Fighter”. The game is about alien invasion. Our lovely Earth is attacked by alien spaceship. It is our duty to protect our homeland. We made our own spaceship for rescuing and defending against them. As the player plays the levels get harder. Skills are needed for shooting down the alien spaceships. By destroying each spaceship, the player will be given points. When the player can defend their territory in game he/she will be announced the winner. If he/she fails to defend their territory, then it will be game over. The player needs to complete 10 levels in 3 minutes. Their highest scores will be stored in game. For developing the game, we use Unity 3D as game engine. We use multiple software such as Adobe Photoshop, Adobe Illustrator, Autodesk 3Ds max and Blender for making our character modeling.

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CHAPTER 1

Introduction

1.1 Introduction

The project is about Augmented Reality Game. We make a AR Unitybased Space Shooting Game which is make for Android based devices. Our game depends on a few Spaceships. Our amusement's fundamental character is Spaceship from another planet which invaded planet Earth. The game contains ten levels. The player which is another Spaceship from Earth need to shoot and destroy the alien Spaceship. By completing each level, it will become harder to shoot the spaceships. We put a little timer. The player need to complete all the levels between this time. If the player can't destroy all the spaceship in time the game will be over. We fundamentally utilize Unity ARVuforia(Vuforia empowers Unity designers to make connecting with AR encounters and contact the broadest conceivable gathering of people) software. We likewise utilize Visual Studio 2017(for game scripts), the Adobe Illustrator (for making the canvas panel objects) and Autodesk 3Ds Max (for 3D modeling). Our fundamental objective is to have amusement while playing games.

1.2 Motivation

As a gamer, we have been keen on computing began. Our own particular experience of playing games for entertainment has driven us to consider many questions and techniques for building up a game. This project has given us the chance to investigate the world of games to discover the solutions to our questions.

Our insight into gaming field toward the begin was critical. We know for the most part about amusement creating without knowing anything particular about the animation, code and general structure of a game that we play. As this is a subject we interested in making our career in developing a game and how this can be affected by people. It appears a natural decision of study which we knew would be both challenging and interesting.

1.3 Objectives

The center goals which have been assigned as fundamental to the project seem to be:

- The prompt objective of our game is to envision aggressive improvements and moves in a single's industry and formulate best coral activity alternatives. A definitive long-term target of our game is moved administrative concentration from inner to outside.
- Gain a superior comprehension of the total competitive field.
- Develop reality based market/industry situations.
- Develop the capacity to adopt the thought process of a contender among inside "specialists".

1.4 Expected Outcome

- Know the methodology of creating game assets, animations, prototyping.
- Enhancement of skills about product marketing.
- Improves critical thinking and analysis.
- Making various levels of game with intelligent AI program.

1.5 Report Layout

The following description is given to understand which section covers which themes furthermore, their relevant discussions.

- In the 'Chapter 1', "Introduction", the fundamental guideline and reason for this project is described.
- In the 'Chapter 2', "Background", relevant researches and works which have been studied will be briefly described.
- In the 'Chapter 3', "Requirement Specification", there is a description about the tools and pre-processing tasks.
- In the 'Chapter 4', "Design & Implementation", a brief discussion will make on how the project has been created.

- In the 'Chapter 5', "Testing", a brief summary on how we expand our project.
- In the 'Chapter 6', "User Manual", discussion of how to play the game appropriately.
- In the 'Chapter 7', "Conclusion", gives an overall conception regarding the obstacles we faced along with the achievement.

CHAPTER 2

Background

2.1 Introduction

Keeping in mind the end goal to completely welcome the necessities of a game creating framework [1], it is imperative to have subtle elements on the following:

- Current techniques utilized as a part of industry for creating game.
- A comprehension of the organizations accessible.
- Implementation subtle elements of the strategies utilized as a part of game improvement.

This part is worried about techniques utilized by associations in industry with troubles of game creating.

The principal thing to ask is for what valid reason is it important to build up a game precisely?

Since one can normally have fulfilled by playing this game at the first occasion when he plays this game. Contrasting and alternate recreations one can without much of a stretch see the distinction to entrance a gamer effectively.

2.2 Related Works

We were inspired by playing these two games. These two games are based on Augmented Reality.

2.2.1 SpacePortal Augmented Reality

SpacePortal Augmented Reality [2] is an Augmented Shooting Game developed by ARgamingTT. This game's platform is based on Alien which invades your location. The player needs to defend their location by destroying Alien with guns and other weapons.

We were impacted by SpacePortal Augmented Reality for making our game. We took after the authentic topic of SpacePortal Augmented Reality. In any case, the narrative of our game is totally extraordinary.

2.2.2 POKÉMON GO

Pokémon GO [3] is developed by “Niantic, Inc”. It gives you a chance to utilize your mobile camera to overlay Pokémon onto a perspective of this present reality since dispatch, yet the execution has dependably been somewhat basic. As the main sensor it truly thought about was the mobile camera, Pokémon simply kind of skimmed about in the space before you. You could turn left/appropriate to point, however in the event that you took a stab at drawing nearer or promote away, the Pokémon would simply skim around with you.

2.3 Comparative Studies

We were astonished after playing these two game. So we chose to make our own game. Before making the game we needed to figure out a great deal about how Augmented Reality chips away at any cell phone. We discovered that it utilizes the default camera of any advanced mobile phone and uses the gyroscope for rotation [4].

In spite of the fact that our game has a few similitudes with this two game, we attempted to make this game as one of a kind as conceivable by making our own particular characters and ideas by utilizing another story. We made custom buttons and interior framework for our project. For this we learned to use Adobe Illustrator. For the coding we learned Unity Based C#.

CHAPTER 3

Requirement Specification

3.1 Key Resource Requirements of the Project

There is a table about key assets necessities of our task. It has given beneath.

Table 3.1: Key Resource Requirements


Major Project Activities	Expertise Required	Resources	Constraints
User Interface Design	Learn UI Design's clear approach, showed with genuine cases and instructional exercises	Real-life examples and tutorials	Compatibility with different devices.
Level Design	Capacity to convert parts of the story into playable levels	One of a kind thought	Conflicting Ideas per level
Physics Engine	Learning of capacities accessible In Unity and capacity to transform them as required	Unity game engine	Capacity to point intelligent mixtures of levels
Graphics Design	Information of graphical displaying and execution	3d model design using Adobe Photoshop CC and Autodesk 3Ds max.	Visibility of the points of interest on 3d models
Music Development	Capacity to fuse sound Clips easily into the game	Audio Clips from web	Capacity to play sound clasps in valuable circumstances amid the game play.




Level Implementation	Commonality with the scripting dialect of the game	Collected data from web	Higher levels are so much difficult to complete
Testing	Functionality Testing Compatibility Testing Play Testing	Different types of Android devices	Time consuming
Documentation	Information about SRS and formal report composing	Thought from the Supervisor of the project	Diversion reports are not quite the same as ordinary ones

3.2 Implementation Tools Required

There is a table about execution instruments required in our venture. We utilized such a large number of devices in our undertaking and table is about those devices. The table is given underneath.

Table 3.2: Implementation Tools

Logos Of Companies	Product of	Tool	Usage	Work Exp.
	Unity Engine 2017.3.1f1	Unity AR Vuforia, Unity 3D And Unity 2D	AR engine and Game engine	Frontend and Backend activity

 <p>Visual Studio</p>	Microsoft	Visual Studio 2017	Writing Scripting	Backend Scripting
	Adobe	Adobe Illustrator	Graphics design	Create 2D logos
	Adobe	Adobe Photoshop	Image Editing	Inventory, Start screen image, menu bar, health bar etc.
	Blender	Graphics Design	Create Bullet, 3D Model	Create 3d models and animate.
	Autodesk 3Ds max	Graphics design and animation	Create spaceship	Create 3d models and skull architecture.

3.3 Use Case Modeling and Description

Player can start a game by opening the application. Then he/she will have two option (Play and Exit). If the player choose play, then the game will start with an introduction. In game play there will some options like Level, Time, Score. After the game is over the score will be saved. By choosing Home the player can go back to Menu. Exit will close the application.

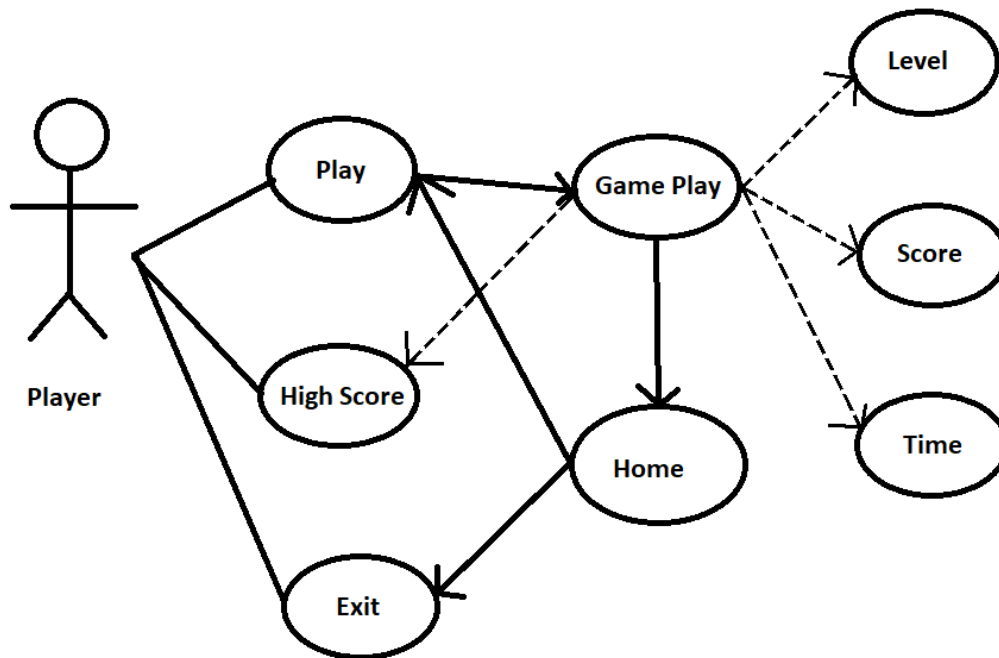


Figure 3.1: Use Case Diagram

CHAPTER 4

Design & Implementation

4.1 Product Design Terms

For each venture product two key terms of design are necessary. They are:

- User Experience
- Backend Programming

4.1.1 User Experience (UX)

To maintain a strategic distance from a pointless item includes, improving plan documentation and customer-facing specialized open at, incorporating business and promoting objectives UX [5] design is must.

User experience design (UXD or UED) is any parts of a user's involvement with a given framework, including the interface, illustrations, mechanical plan, physical association, and the manual much of the time.

User Experience Design completely envelops conventional Human-Computer Interaction(HCI) outline, and broadens it by tending to all parts of an item or administration as saw by users. UX remains for the most part pertinent access of ease of use, accessibility and HCI.

UX characterizes users encounter as "a man's observations and reactions that outcome from the utilization or foreseen utilization of an item, framework or administration".

4.1.2 Backend Programming

Basically application front end is the thing that you see (i.e. the User Interface) and application back end is the application motor that you don't see. The "back end" is the

code supporting that front end (in charge of database get to, business rationale and so on.).

Foe effective execution, to build client acknowledgment both two are imperative in programming industry.

4.2 System Features of Our Game

1. 360-degree Camera View
2. Title Screen
3. Home Menu
4. Instruction Label
5. Sound Controlling
6. Record High Score
7. Real Time Score
8. Level Indicator
9. Game Timer
10. Exit Point

4.2.1 360-degree Camera View

The smart phone camera is used for the background of the game as it is Augmented Reality based game. For the 360-degree view [6], we enabled the gyroscope of the smartphone.

The player can play the game only in first person view. This camera is used for a total view of the player's real time environment. When the player rotates the smart phone they can see the enemy spaceship approaching from all the directions.

4.2.2 Title Screen

The title screen is the screen the player will see every time upon playing the game. It contains the play and exit button.

Response Sequences

Stage 1: The player launches the game from their convenient gadget.

Stage 2: The begin screen stacks and shows up, provoking the player with two buttons: "Play" and "Exit".

Functional Requirements

REQ-1: The title screen must load and seem each time the game is launched.

REQ-2: If the player back the game during any phase of a level, they should be come back to the title screen.

REQ-3: If the player presses the exit button, the game will end and restore the player's high score.

REQ-4: If the player finishes the game, the game will end and restore the player to the title screen.

4.2.3 Home Menu

The player ought to have the capacity to homeduring or after game play, and this screen satisfies that necessity. The home menu likewise enables the player to explore between game play and the title screen.

Stimulus

Stage 1: The player presses the home button on the game-play interface.

Stage 2: The home brings back to the title screen which prompts the player with two choices: "Play" and "Exit".

Functional Requirements

REQ-1: The "Play" alternative must proceed with the game with no change to the score or the condition of the level.

REQ-2: The "Exit" alternative must quit the application.

4.2.4 Instruction Label

Launch the game and glance around with your camera to discover the outsider spaceships moving around you. Prepare to destroy all the outsider spaceships and spare the humankind from the destruction!

4.2.5 Sound Controlling

Sound play a fundamental need in the game. Without music a player really doesn't feel the game. Then again, a few people don't care for the uproarious music during the game-play. So we put the sound control on player's hand. They can control the sound and music of the game by themselves. This function allows the player to toggle between mute and unmute any sound. This can also be found in the pause menu while playing game.

4.2.6 Record High Score

The game stores highest achieved score after game over. It's also displayed on the player's spaceship. Whenever the player conquers a new high score, it will be displayed during game-play.

4.2.7 Real Time Score

By destroying Alien Spaceship, the score will be increased automatically. It will also be displayed in real time game play.

4.2.8 Level Indicator

Level is shown in real time game play. By completing each level, level score will increase along with level difficulty.

4.2.9 Game Timer

This timer shows how much time is left to finish the game. If the player is unable to complete all 10 levels in time, then it results in game over. There is a time bar for counting the time.

4.2.10 Exit Point

When the player presses “Exit”, the application will close. Although the application closes, it stores the high score.

4.3 Character Design and Development

4.3.1 Character Modeling

We utilized various types of devices for making our characters, for example, Adobe Photoshop CC, Adobe Illustrator CC, Blender, Autodesk 3Ds Max.

Models

- Player Spaceship
We have created our character’s 2D model by using Adobe Photoshop CC and Adobe Illustrator.



Figure 4.1: Basic 2D player model

- Enemy Spaceship

We have created our character's 3D model by using Adobe Photoshop CC, Autodesk 3Ds max, Blender and Adobe Illustrator.

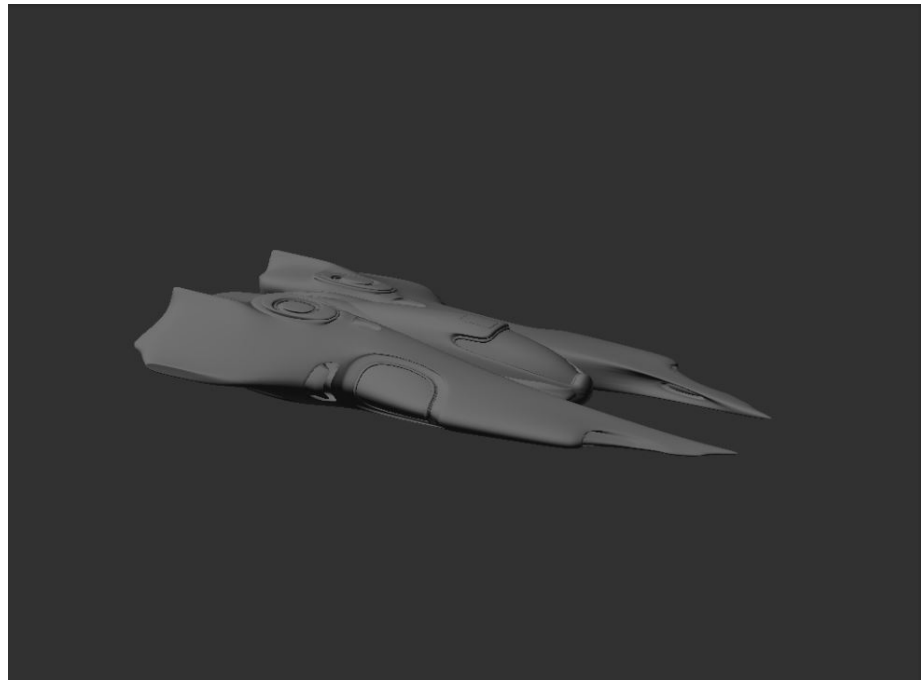


Figure 4.2: Base 3D enemy model



Figure 4.3: The front view of enemy spaceship



Figure 4.4: The side view of enemy spaceship



Figure 4.5: The rear view of enemy spaceship

- Bullet

We have created our character's 3D model by using Adobe Photoshop CC, Autodesk 3Ds max, Blender and Adobe Illustrator.



Figure 4.6: 3D model of bullet

- Crosshair

We have created our character's 2D model by using Adobe Photoshop CC and Adobe Illustrator.

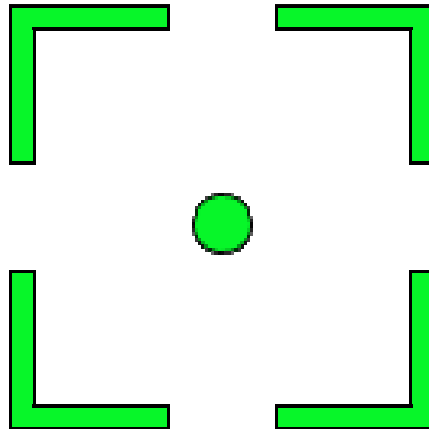


Figure 4.7: Crosshair

- Particle

We used Unity Engine Particle. When an enemy Spaceship is destroyed it is used.

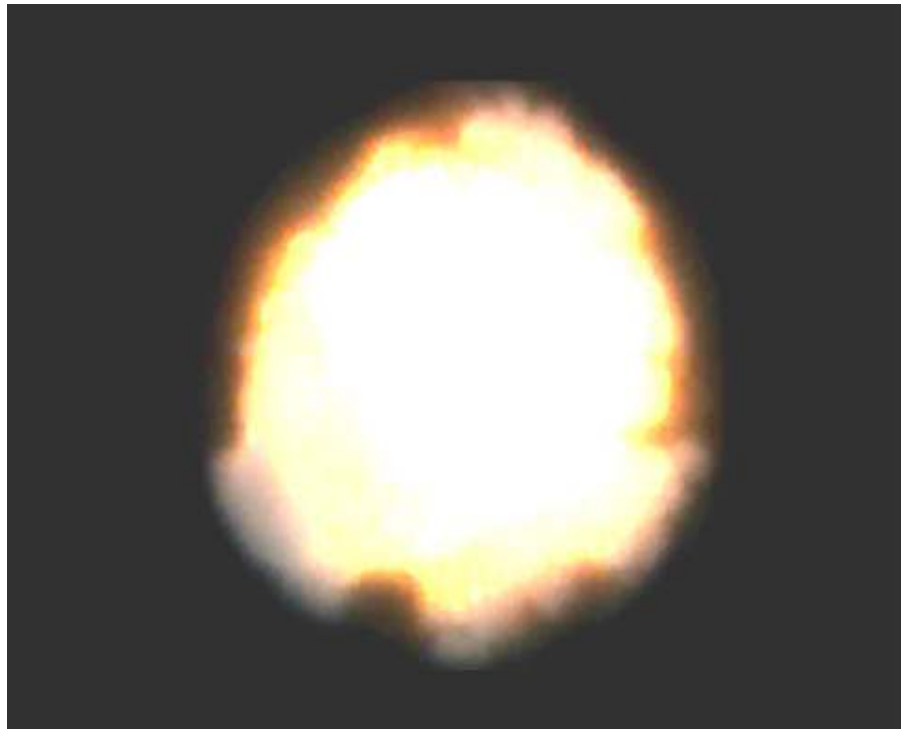


Figure 4.8: Flame particle

4.3.2 Character Scripting

➤ **Player**

- First Person Camera (Web Camera)
- Shoot
- Player Controlling
- Level Up

➤ **Enemy**

- Enemy AI Handler
- Collision
- Score Manager
- Spawn Point
- Clone

➤ **Bullet**

- Collision
- Clone

➤ **Shoot**

- Clone Bullet

➤ **Timer**

- Time Controller

4.4 Mechanism

4.4.1 AR Camera

Augmented Reality (AR) [7] alludes to sending virtual picture over certifiable articles. The overlay is executed at the same time with the info got from a camera or another

information gadget like shrewd glasses. This superimposition of virtual pictures over real-world objects makes a deception that can successfully draw in clients in a virtual world.

4.4.2 Environment

Setting Design centers around the end-client's physical encompassing, spatial space, and openness that may assume a part when utilizing the AR framework. Originators ought to know about the conceivable physical situations the end-client might be in, for example [8],

- Public, in which the clients utilize their entire body to collaborate with the product
- Personal, in which the client utilizes a cell phone in an open space
- Intimate, in which the client is sitting with a work area and isn't generally in development
- Private, in which the client has on a wearable.

Particularly in AR frameworks, it is fundamental to likewise think about the spatial space and the encompassing components that change the viability of the AR innovation. Natural components such as lighting, and sound can keep the sensor of AR gadgets from distinguishing fundamental information also, destroy the drenching of the end-client.

4.4.3 Interaction Design

Association configuration in enlarged reality innovation fixates on the client's commitment with the item to enhance the general client experience and delight. The motivation behind Interaction Design [9] is to abstain from estranging or confounding the client by arranging the data introduced. Since client communication depends on the client has input, originators must make framework controls less demanding to comprehend and available. A typical procedure to enhance ease of use for increased reality applications is by finding the as often as possible gotten to regions in the gadget's touch show and plan the application to coordinate those zones of control. In communication plan, it is critical

for engineers to use expanded reality innovation that supplement the framework's capacity or then again reason. For example, the usage of energizing AR channels and the outline of the special sharing stage in Snapchat empowers clients to better the client's social collaborations. In other applications that expect clients to comprehend the concentration and plan, creators can utilize a reticle or recast from the gadget. In addition, increased reality engineers may discover it suitable to have computerized components scale or respond to the bearing of the camera and the setting of articles that can be identified. The most energizing variable of increased reality innovation is the capacity to use the presentation of 3D space. This implies a client can conceivably get to different duplicates of 2D interfaces inside a solitary AR application. AR applications are collective, a client can likewise interface with another's gadget and see or control virtual questions in the other individual's specific situation.

4.4.4 Visual Design

When all is said in done, visual plan is the presence of the creating application that draws in the client. To enhance the realistic interface components and client collaboration, engineers may utilize visual prompts to illuminate client what components of UI are intended to connect with and how to interface with them. Since exploring in AR application may show up troublesome and appear to be baffling, visual prompts configuration can influence cooperation's to appear to be more normal. In some increased reality applications that uses a 2D gadget as an intelligent surface, the 2D control condition does not decipher well in 3D space making clients reluctant to investigate their environment. To tackle this issue, originators ought to apply visual [10] signals to help what's more, urge clients to investigate their environment. It is essential to take note of the two fundamental questions in AR when creating applications: 3D volumetric items that are manipulated and reasonably associate with light and shadow; and vivified mending symbolism, for example, pictures and recordings, which are generally conventional 2D media, rendered in a new setting for expanded reality. At the point when virtual items are anticipated onto a genuine condition, it is trying for expanded reality application architects to guarantee a consummately consistent coordination in respect to

this present reality condition, particularly with 2D objects. In that capacity, originators can add weight to objects, utilize profundities maps, moreover, pick diverse material properties that feature the protest's essence in reality. Another visual outline that can be connected is utilizing distinctive lighting procedures or throwing shadows to enhance general profundity judgment. For example, a typical lighting strategy is basically setting a light source overhead at the 12 o'clock position, to make shadows upon virtual objects.

4.4.5 Game Physics

This game belongs to some of game physics like:

- Collusion
- Firing
- Flaming
- Spaceship Movements
- Destroy Effect
- Timer Count
- Enemy Auto Respawn

CHAPTER 5

Testing

5.1 What is Testing?

Game testing although very unique in relation to the general programming testing yet at the same time it acquires all the fundamental parts of programming testing. On the first and essential premise game testing is viewed as just the convenience and the look and feel highlights of the amusement. Be that as it may, testing a game is substantially more than this. Not just Entertainment part, there are numerous different perspectives to be engaged upon. The following are the different factors on which game testing should be finished.

5.2 Test Case 1

Test Case	: This test will check if the assets are working correctly.
Test Procedure	: Import a character model in unity. Place character On the scene. Run the game.
Expect Result	: Assets works perfectly in the environment.
Actual Result	: Assets is not working.
Comment	: Need to check for character configuration on inspector window. The appropriate animation was not selected. Select it.
Conditional Test	: Again run scene.
Expected Result	: Assets now working.
Actual Result	: Yes, it's working.
Accuracy	: Accuracy depends on hardware configuration.

5.3 Test Case 2

Test Case	: This test will check if the AR Camera is working correctly.
-----------	---

Test Procedure : Add scripts of AR Camera to work for all android devices. Run scene gain.

Expected Result : AR Camera is working perfectly.

Actual Result : Simple for some phones.

Comment : Need to work on AR Camera script for the objects that have a particular Script.

Conditional Test : Run scene.

Expected Result : AR Camera is ok now.

Actual Result : AR Camera is ok now.

Problem : AR Camera works perfectly only in 90-degree landscape mode of smart phone.

5.4 Test Case 3

Test Case : This test will check if the collision between object is working correctly.

Test Procedure : Add scripts of collision in the object that we want to interact with each other. Run scene.

Expected Result : Objects are collision.

Actual Result : Runtime exception.

Comment : Need to work on collision script for the objects that have a particular Script.

Conditional Test : Run scene.

Expected Result : Collision is ok now.

Actual Result : Collision is ok now.

Accuracy : Perfectly accurate.

5.5 Test Case 4

Test Case	: This test will check if the scores are stored accurately along with level up.
Text Procedure	: Add score and level label in the scene. Run scene.
Expected Result	: Score and Level appear in the correct location.
Actual Result	: Scores were not working in real-time.
Comment	: Tweak some values and it worked.
Actual Result	: Score and Level works real-time.
Accuracy	: Both Score and Level works perfectly

CHAPTER 6

User Manual

6.1 Playing Procedure

This part gives a client direction to the players. It incorporates the methodology of playing and furthermore contains a few previews to give a few thoughts of the diversion to the player before beginning playing it.

AR Fighter is actually an arcade mode game where the Earth spaceship taking down enemy Spaceship continuously. Here's how exactly users will interact with the game, given below.

6.2 Start the game

Toward the start of the game, player sees a title screen with a few buttons, for example, Play, Instruction, Option, Exit and so on. Player ought to pick one alternative. In the event that he/she picked Play Menu, then the game will begin from the earliest starting point level.

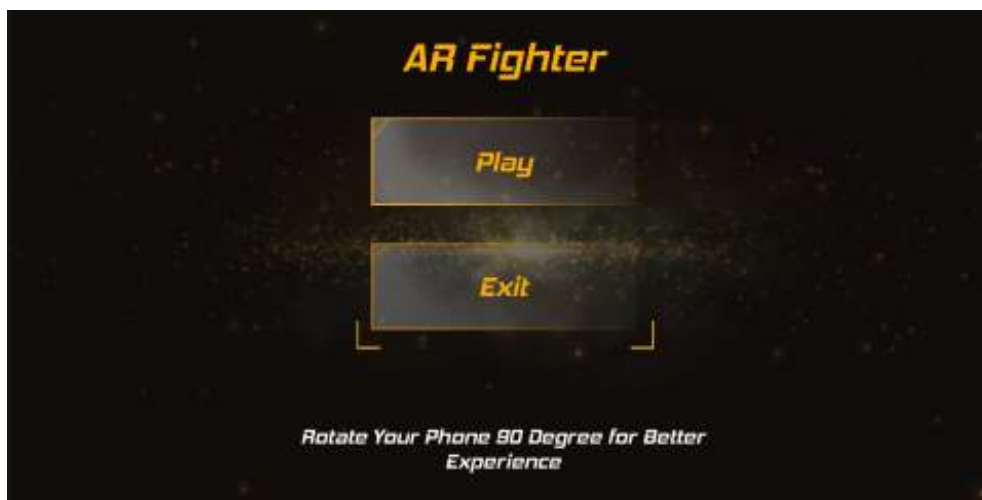


Figure 6.1: Title screen

The instruction helps the player to understand the game. There is a shot description about how to play the game. The player needs to allow camera for this game to work perfectly. They can also use their phones to control the player.

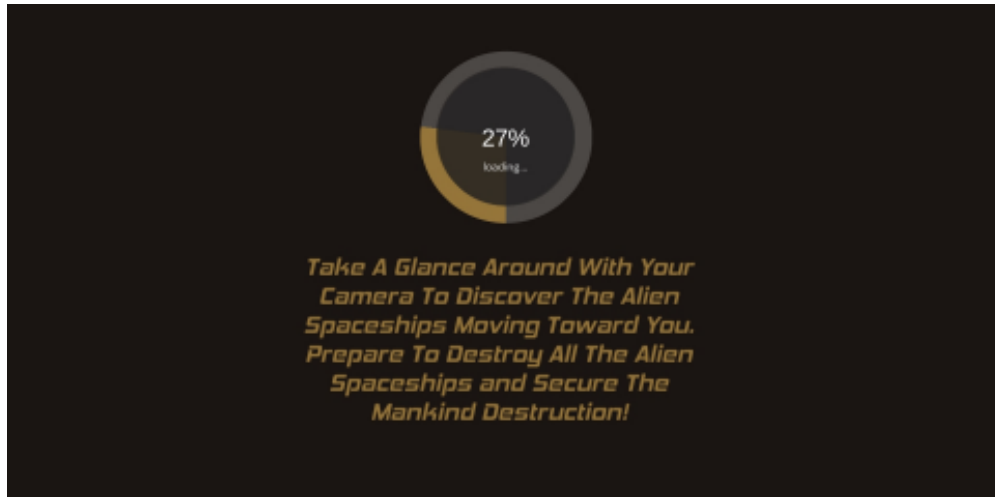


Figure 6.2: Loading screen

The Sound Control relies upon how player needs to play the game. A few people need to play game without music; then again a few needs music to feel the game excite. So we put choice menu for the players.



Figure 6.3: Enemy approach



Figure 6.4: Enemy destroying effect

The Exit menu is for stopping game. At the point when the player needs he/she can stop the game by Exit menu.



Figure 6.5: Game over screen

6.3 The Levels

The Game contains 10 distinct levels which depends on 10 unique Enemy Movement Pattern. In every level the player will be introduced with enemy with higher AI skill. It

will get difficult to shoot and destroy them. After completeing each level with appropriate score player can go to a next level. When all the levels are completed the player will be announced winner. But if the player can't complete all the levels then the game is over.

CHAPTER 7

Conclusion

7.1 The Obstacles

Making a game is not an easy task. It needs a lot of experience, practice and co-operative work. We faced various kind of problems while creating this game. Finding the resources was the hardest part of them all. As we are not expert in Graphics Designing, creating the 3D objects was very difficult for us. We took help from the web for tutorials.

Then comes the part of AR. AR is the new future of game industry. As our project is a marker less AR game we had to implement all the things in many ways to find the perfect solution while facing any problem. Here is some of our personal experience:

- Working with diversion motor totally another experience for us. Regularly we are working with various OO dialects, DBMS, increase dialects and so forth.
- We receive these things by video instructional exercises, content instructional exercises, web and learning materials given by the devices themselves. It's a short time, tolerance and diligent work.
- It is exceptionally sensible work and it requests much time in light of the fact that the diversion motors endeavor to interface amusement condition with this present reality.
- Creating a 3d demonstrate is extremely troublesome in light of the fact that you have to work with every single purpose of the model.
- The Exists diversion motors requests immense information about its properties, areas and sub-segments.

After all the thing is that a game project isn't a task of 6 or 8 months for three individuals.

7.2 The Achievements

Creating this project is one the biggest achievement of our life. We want to create more projects like this in near future.

- Now we discover substantially more about game engine. How it functions? The properties, articles and others.
- We know how a model is built and how it is energized.
- The primary concern is that as a PC specialist, aptitude and mastery to make a SRSarchive and a general programming item report is currently better than anyone might have expected.
- Co-Operation between bunch individuals.
- Develop relational abilities
- Growing inventive reasoning and creative ability capacity.

7.3 Future Plan

We have some plans which we want to do in future. Here are some features:

- Level Extension
- Improve Graphical Representation
- Introduce new game highlights
- Introduce new condition and scenes
- Enemy gain power to attack after certain level
- Take client reaction through site and deliver web rank rundown
- Different skins for both the player and the enemy
- Burst mode for shooting
- Blast mode which needs to active after certain time
- To unlock Burst and Blast mode player need to collect stars while playing
- Manual level change

7.4 Few Words

We took in a great deal through this task. This undertaking has honed our idea of Game engine and the product equipment interface.

We took in a great deal about various documentation. The bit of programming we created is proposed to serve the gamers of the world. The achievement of this undertaking may offer delight to billions of game lovers among the universe. This undertaking tried our specialized aptitudes as well as our demeanor.

There were times that we relatively lost expectation yet we recuperated through consistent fixation and diligent work.

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