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Quiver VR-Arctic Kill

In partial fulfilment of the requirements for the degree of

Bachelor of Science in Computer Science

Supervisor: Summaira Nosheen

Department of Computer Sciences

Bahria University, Lahore Campus

June 2018

Certificate

We accept the work contained in the report titled
"QUIVER VR-ARCTIC KILL",
written by
AMMAR MUSLEH
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as a confirmation to the required standard for the partial fulfilment of the degree of Bachelor of Science in Computer Science.

Approved by:

Supervisor: Ms. Summaira Nosheen

______________________________ (Signature)

June 4th, 2018

DECLARATION

We hereby declare that this project report is based on our original work except for citations and quotations which have been duly acknowledged. We also declare that it has not been previously and concurrently submitted for any other degree or award at Bahria University or other institutions.

Enrolment	Name	Signature
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Date : ____________________________

Specially dedicated to
my beloved mother, father, Dadu, Nano and friends
(AMMAR MUSLEH)
my beloved mother, father, Dadu, Nano and friends
(HAMZA MUSHTAQ)

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In addition, We would also like to express my gratitude to our loving parent and friends who had helped and given me encouragement.

AMMAR MUSLEH
HAMZA MUSHTAQ

QUIVER VR – ARCTIC KILL

ABSTRACT

Quiver VR is a virtual reality based gaming system. It runs on desktop gaming platform and capture gestures of the player to perform actions in the game. The display of the game is projected to a mobile phone which becomes a part of a mobile virtual headset. Mobiles orientation in real world moves the scene view in game.

Arctic kill is the first person shooter game with a snow environment and zombie characters as enemies. The player in game has a gun in hand controlled by the gestures of his hand. Zombies in game try to kill the player. Zombies throw ice and fireballs towards the player. User wearing the head mounted display sees this virtual environment with which he is interacting with bare hands.

Specially designed feedback gadgets provides a real gaming sensation of the virtual environment to the player for an enhanced gaming experience. The snow and ice balls thrown towards the player triggers an action which turns the gadget worn by player to cold or hot.

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LIST OF SYMBOLS / ABBREVIATIONS

VR	Virtual Reality
FPS	First Person Shooter
GPU	Graphics Processing Unit
FPV	First Person View

CHAPTER 1

INTRODUCTION

1.1 Background

Virtual reality is the art of simulating real experience by generating virtual environment. The current systems that exist are small bits of a bigger picture. Either they are based on VR or they just run on hand gestures. PC VR gaming is also not very affordable setup. The only actions performed are on the system by the player to interact with the virtual world. The system is not giving a proper feedback of the virtual environment to the player in real.

This can be revolutionized to bring in a much better gaming experience for the world. Gesture gaming is selling like hot cake but is not that accurate to feel the reality of actions being performed. There is much to be done in these domains to mix up the adventure and bring up action packed reality based gaming environments.

1.2 Problem Statements

There is a rapid acceptance of Virtual reality in the life of people. But is the technology's real form approachable for everyone? According to a survey 87% of VR headset sold were for mobile phones while 9% were the Gaming console VR[4] and only 4% were the PC based models. The primary cause is the high-priced devices for PC.

The aim for the project is to bring in PC VR experience as the most commonly used gaming and simulation platform to an affordable VR enabled experience. This will increase the overall demand for the VR and decrease the geographical imbalance of the sale of VR worldwide.

Mobile VR only provide head mount virtual 3D displays. We brought the 3D desktop gaming VR experience to low budget mobile VR. A game is designed to work without the need of any hefty controllers and works with gestures and hand movements. Gadgets are made in accordance with the theme of the game that will give player the real game feels.

Thus, the need for heavy and odd-looking gaming VR is replaced with low cost and easily approachable mobile VR for the best PC based gaming experience in virtual 3D world. The game is a first person shooter having attractive and detailed graphics with creative all over view. The story and theme is implemented at its best which self-explains the whole plot to the player.

1.3 Aims and Objectives

“To bring virtual reality gaming experience to an affordable price with gesture controlled PC game using mobile VR and additional gizmos for real time gaming sensations.”

1.4 Scope of Project

This theme of the project is to bring virtual reality gaming experience to an affordable cost for PC. The use of hefty PC gaming VR is replaced with smart and easily accessible mobile VR.

A specially designed 3D virtual game is developed that captures and interpret the hand gestures of the player and act accordingly in the game [2]. The hand gestures are captured using leap motion device. Leap motion captures the bone structure and joints of hands to trace the position of hand. It is very precise and accurate. The game runs in PC and mobile device acts as a display for the game in VR device. Any android phone can be used to act as a display for the PC game.

Uniquely designed gadgets gives real feeling and sensations of the game while it is being played. The player not only give input to the game but also get feedback from the virtual world. This makes a two-way interaction between the player in reality and the virtual game environment.

CHAPTER 2

SOFTWARE REQUIRNMENT ENGINEERING

2.1 Proposed System

2.1.1 Overview

The proposed system is a PC game that provides VR experience utilizing mobile device resources. Player's inputs are captured using leap motion, which trigger actions in the game. The system understands the environment of the game and returns feedback from the VR world to player by controlling gadgets attached to the player.

2.1.2 Functional Requirements

- The system shall allow user to start the game
- Game shall be running on Window PC
- Game shall be projected on an android mobile
- Game shall provide First person shooter view to the player
- Game shall provide sound effects
- System shall capture the gestures of the player
- System shall communicate with Arduino properly
- Arduino shall switch Peltier chips efficiently
- System shall differentiate between right and left hand
- Each hand shall be given different functionality in the game

- System shall match and understand gestures and trigger actions
- System shall be able to replicate the player’s real time head movements
- Game shall display player health on the screen

2.1.3 Non-Functional Requirements

- The game should run on high fps rate
- Peltier chip must be turned on for 6sec
- PC must have 8gb of RAM
- PC must be having a good graphics card
- Mobile display should have a high resolution
- The code of the game must be maintainable
- Riftcat/Trinus acts as a bridge between mobile VR and PC
- PC should be Bluetooth enabled for connectivity with the feedback gadget
- 12v battery should be properly utilized to make the circuitry run seamlessly

2.2 Hardware Specifications

2.2.1 Arduino Uno

SPECIFICATION [5]

Figure 1: Arduino Uno

- Microcontroller ATmega328P
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limit) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins6
- Analog Input Pins 6
- DC Current per I/O Pin 20 mA

- DC Current for 3.3V Pin 50 mA

ROLE IN PROJECT

Arduino controls the Peltier chips by governing the relay module and enable the communication between the gadget and the game using Bluetooth.

2.2.2 **Relay Module**

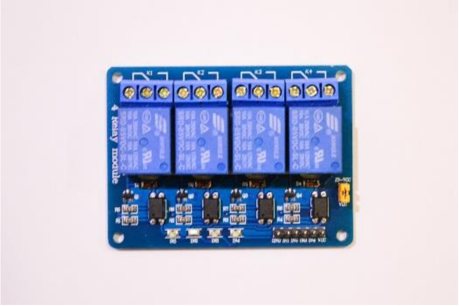


Figure 2: Relay Module

SPECIFICATION [6]

- Working Voltage DC24~30V
- BUS Power Consumption 24V
- Relay 50A Magnetic latching relay
- Output channel 4CH/16A
- Max current in each channel 16A
- Electronic lifetime for relay > 60000 Resistance Load

ROLE IN PROJECT

The relay module switches the Peltier on an off which is controlled by Arduino. In total 8 relays are used to control 4 Peltier chips.

2.2.3 **HC-05 Bluetooth module**

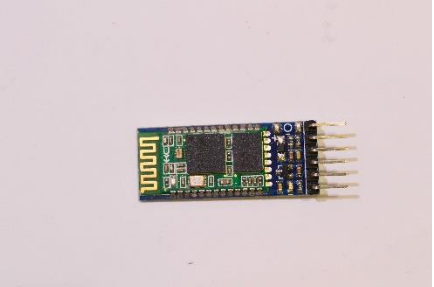


Figure 3: HC-05 Bluetooth module

SPECIFICATION [7]

- Bluetooth protocol: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK (Gaussian Frequency Shift Keying)
- Emission power: ≤4dBm, Class 2
- Sensitivity: ≤-84dBm at 0.1% BER

- Speed: Asynchronous: 2.1Mbps (Max) / 160 kbps, Synchronous: 1Mbps/1Mbps
- Size: 28mm x 15 mm x 2.35mm
- Security: Authentication and encryption
- Profiles: Bluetooth serial port
- Power supply: +5V DC (5.5V max)
- Working temperature: -20 ~ +75 Centigrade

ROLE IN PROJECT

Connect Arduino to PC for serial communication. This makes the gadget wireless. Module receives the message sent by the pc and feed it to Arduino to do some actions against it.

2.2.4 **Dc Step Down Variable Voltage Regulator**

SPECIFICATIONS [8]

- Input voltage: 4.5-40V
- Output voltage: 1.25-37V
- Output current: 2A rated current and 3A Max
- Load adjust ratio: +/-0.5%
- Voltage adjust ratio: +/-2.5%
- Transferring efficiency: 92% Max(the higher output voltage, the higher efficiency)
- ON/OFF frequency: 150KHz
- Output ripple: 200mV
- Power consumption when in static statue: only about 3A
- Working temperature: -40 Celsius to 85 Celsius
- Module feature: buck and non-isolated
- Rectification method: non-synchronous rectification

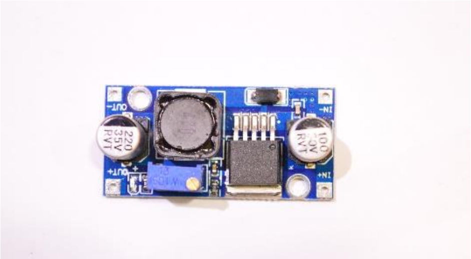


Figure 4: Dc Step Down Variable Voltage Regulator

Adjust method: please use a mini screwdriver to adjust output voltage by adjusting the potentiometer

ROLE IN PROJECT

DC step down converter also called buck converter converts the output 12v DC from battery to 5v DC to power the Arduino. In this way, Arduino functions within its recommended voltage.

2.2.5 **Peltier Chip**

SPECIFICATIONS [9]

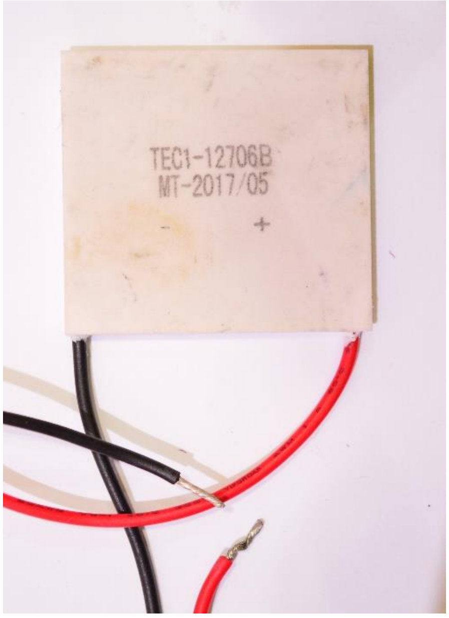


Figure 5: Peltier Chip

- Model: TEC1-12706
- Size: 40mm x 40mm x 4mm
- Operates from 0~15.2V DC and 0~6A for 12706, in a good condition with heat sink, current will rise to 4A.
- Operates Temperature: -55℃～83℃
- Max power consumption: 60 Watts for 12706
- These devices must be used together with a heat sink to avoid burned in 2 seconds after powered up
- The side with words are the cooling side, and other side is the warm side.
- Application: Cooling your CPU, video card, NANO Reef, laser diode, CCD camera, picnic cooler, beverage cooler, even generating electricity. The uses are unlimited.

ROLE IN PROJECT

These chips are installed in a jacket together with a heatsink and a fan. They produce cool effect on the inner side of the chip, which could be felt by the player. They will give real-time feedback to the player against the actions performed in the virtual environment.

CHAPTER 3

DESIGN AND METHODOLOGY

3.1 Design

3.1.1 Main Components

QUIVER VR is comprised of three main high-level components:

- Mobile VR Headset
- FPS Game
- Feedback Gadget

3.1.1.1 Mobile VR Headset

A virtual reality headset allows users to interact with simulated environments and experience a first-person view (FPV). Mobile VR headsets are goggles that holds a mobile device in it. Mobile is connected to PC through hotspot. The game runs in PC and mobile device acts as a display for the game in VR device. Any android phone can be used to act as a display for the PC game.

3.1.1.2 FPS Game

A specially designed 3D virtual game is developed that captures and interpret the hand gestures of the player and act accordingly in the game. The game is a first person shooter game that utilizes the captured gesture from leap motion [3] which is attached in front of VR headset. When player hand comes in range of Leap motion it detects the hand and capture it.

3.1.1.3 Gadgets

Uniquely designed gadgets gives real feeling and sensations of the game while it is being played. The player not only give input to the game but also get feedback from the virtual world. This makes a two-way interaction between the player in reality and the virtual game environment.

3.2 Methodology

We adopted Agile development approach using Feature driven development. The throughout phases of the project are stated below in sequence:

3.2.1 Research

The complete knowledge of the scope of the project and the current state of the domain targeted by the project are tracked and analyzed. A novel hardware is designed and integrated with the game to give a real-life gaming experience. The hardware required is studied for development and integration with other modules.

Gesture is recognized and appropriate action will invoke against it, which will give us real time feedback. Gestures is accurately recognized for high game precision. It is a nontraditional approach where the virtual reality game is controlled by gestures of the player. This system focuses on the accuracy as well as cost effectiveness for the gesture capturing.

Arduino is used to control the gadgets and it also communicate with the game. The gadget related processing is done by Arduino. It is integrated with game using wireless networking methodology.

3.2.2 Planning

- System requirements and the tools required is gathered.
- Features selection and planning
- Hardware configuration and development

3.2.3 Design

All possible UML diagrams is designed here e.g. Architecture diagram Also, this phase deals with interface designing and prototyping.

3.2.4 Feature Building

- ➢ Development
  - Game Engine
    - Game physics
    - Graphics
    - Game Artificial Intelligence
  - Player
    - Arduino scripting
    - VR scripting
    - Leap motion scripting
  - Network

    The networking module connects the game engine module and the player module using:
    - Bluetooth
    - WiFi
- ➢ Testing

Each module is tested after its development.

- ➢ Setup

Tested modules is integrated here to build a complete working system.

The iterative approach of feature building result in the final product.

3.2.5 Feedback

Feedback on the final product is obtained to know the performance measure of the project and the success percentage.

3.2.6 Maintenance

Any faults or changed required is made to increase the satisfaction level and experience of the user.

3.3 System Design

All possible UML diagrams is designed here e.g. Architecture diagram. Also, this phase deals with interface designing and prototyping.

3.4 Use Cases

3.4.1 Use Case Diagram

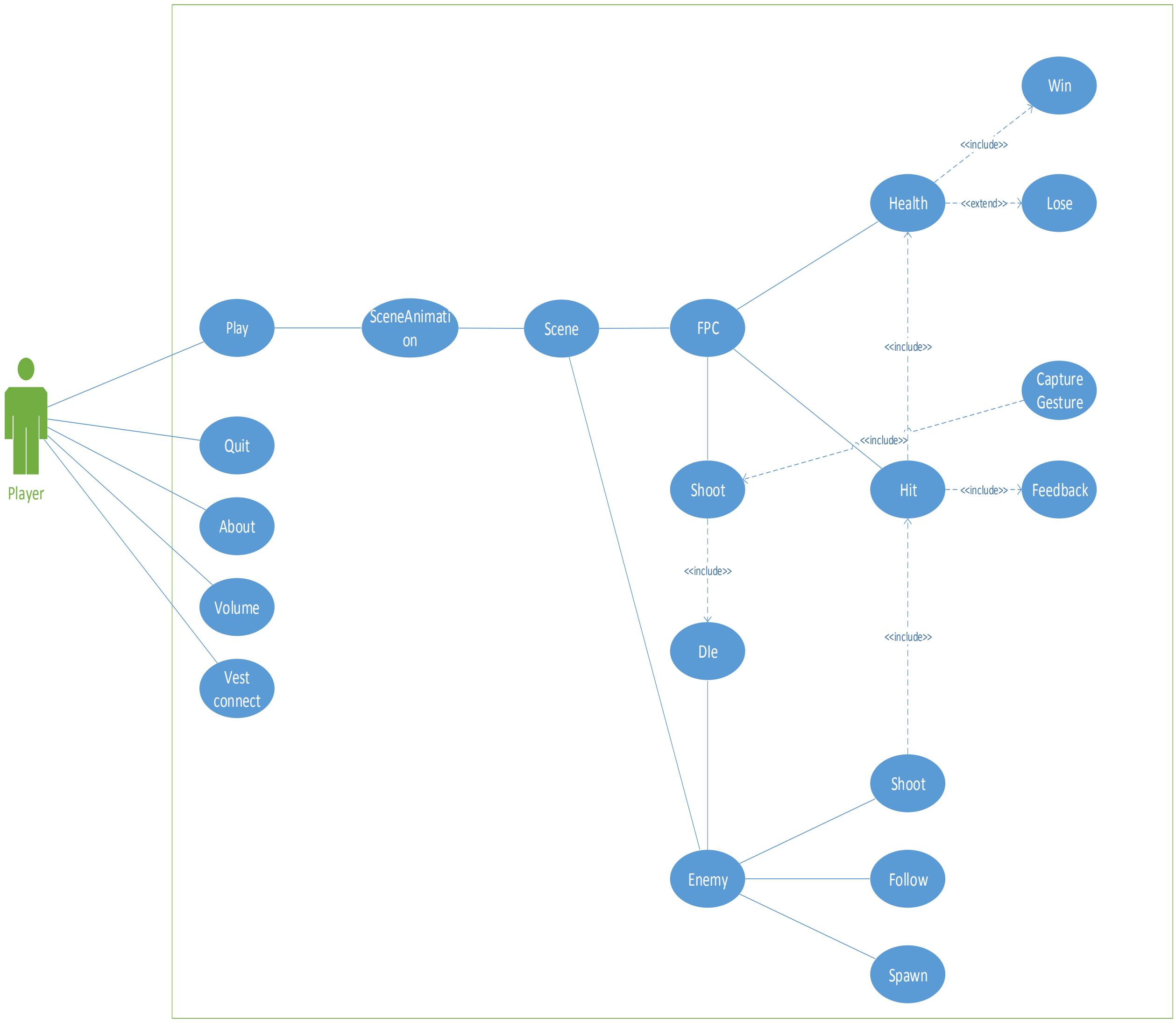


Figure 6: Use Case Diagram of the System

3.4.2 Use Case Model

Name:	StartGame
Actor:	PLAYER
Entry Conditions:	Application is running. A Game is not currently in progress.
Flow of Events:	Player initiates new game function by clicking the start button
Exit Conditions:	Game is now in a playable state.

Name:	Quit
Actor:	PLAYER
Entry Conditions:	Application is running. A Game is not currently in progress.
Flow of Events:	1. Player selects quit function by clicking the quick button 2. Player is asked to confirm his selection
Exit Conditions:	Game is not in running condition anymore.

Name:	About
Actor:	PLAYER
Entry Conditions:	Application is running. A Game is not currently in progress.
Flow of Events:	Player selects the about developer option by clicking the button
Exit Conditions:	Game and developers info is displayed

Name:	LookAround
Actor:	PLAYER
Entry Conditions:	Player moves his head
Flow of Events:	1. Player moves his head to look around 2. Game camera is shifted to the angle of head moved by Player detected by Gyroscope
Exit Conditions:	Camera is in position of the head

Name:	HandInView
Actor:	PLAYER
Entry Conditions:	Player hand comes in range of Leap motion
Flow of Events:	1. The game shows the hand in virtual world 2. Gun is attached to the hand 3. Hand moves in accordance with the Players hand
Exit Conditions:	Moveable hand in game with gun attached

Name:	Shoot
Actor:	PLAYER
Entry Conditions:	Player gives the gesture for shoot
Flow of Events:	1. Player gesture is recognized in the game 2. Gun shoots a bullet in direction of gun
Exit Conditions:	Bullet shot in direction of gun

Name:	Throw
Actor:	ENEMY
Entry Conditions:	Enemy is approaching the player
Flow of Events:	1.ENEMY Throws snow or ice balls towards the PLAYER 2.Ball moves towards the PLAYER
Exit Conditions:	Ball hits the PLAYER

Name:	ENEMY DIE
Actor:	ENEMY
Entry Conditions:	Bullet hits the Enemy
Flow of Events:	1. ENEMY health decreases 2. ENEMY health reaches to zero
Exit Conditions:	Enemy is destroyed

Name:	FeedBack Trigger
Actor:	ENEMY
Entry Conditions:	Enemy hits the Player
Flow of Events:	1. Point of hit is stored 2. Game sends data to Arduino
Exit Conditions:	Arduino receives the data

Name:	Follow Player
Actor:	ENEMY
Entry Conditions:	Player is at a distance to the enemy
Flow of Events:	Enemy starts approaching player
Exit Conditions:	Enemy reaches Player while attacking it

Name:	Vest Connect
Actor:	ARDUINO
Entry Conditions:	Vest not connected
Flow of Events:	1. PC requests to connect to Bluetooth Arduino 2. Arduino authenticates the connection
Exit Conditions:	Vest is connected

Name:	Die
Actor:	PLAYER
Entry Conditions:	Player is hit by enemy.
Flow of Events:	1. Player health was decreased by the Damage 2. Player dies on reaching zero health
Exit Conditions:	Player die and game is over

Name:	Defend
Actor:	PLAYER
Entry Conditions:	Player gives the gesture for defensive shield
Flow of Events:	1. Player is recognized in the game 2. Shield appears in front of PLAYER
Exit Conditions:	Defensive shield deployed

Table 1: Use Case Models

3.4.3 Class Diagram

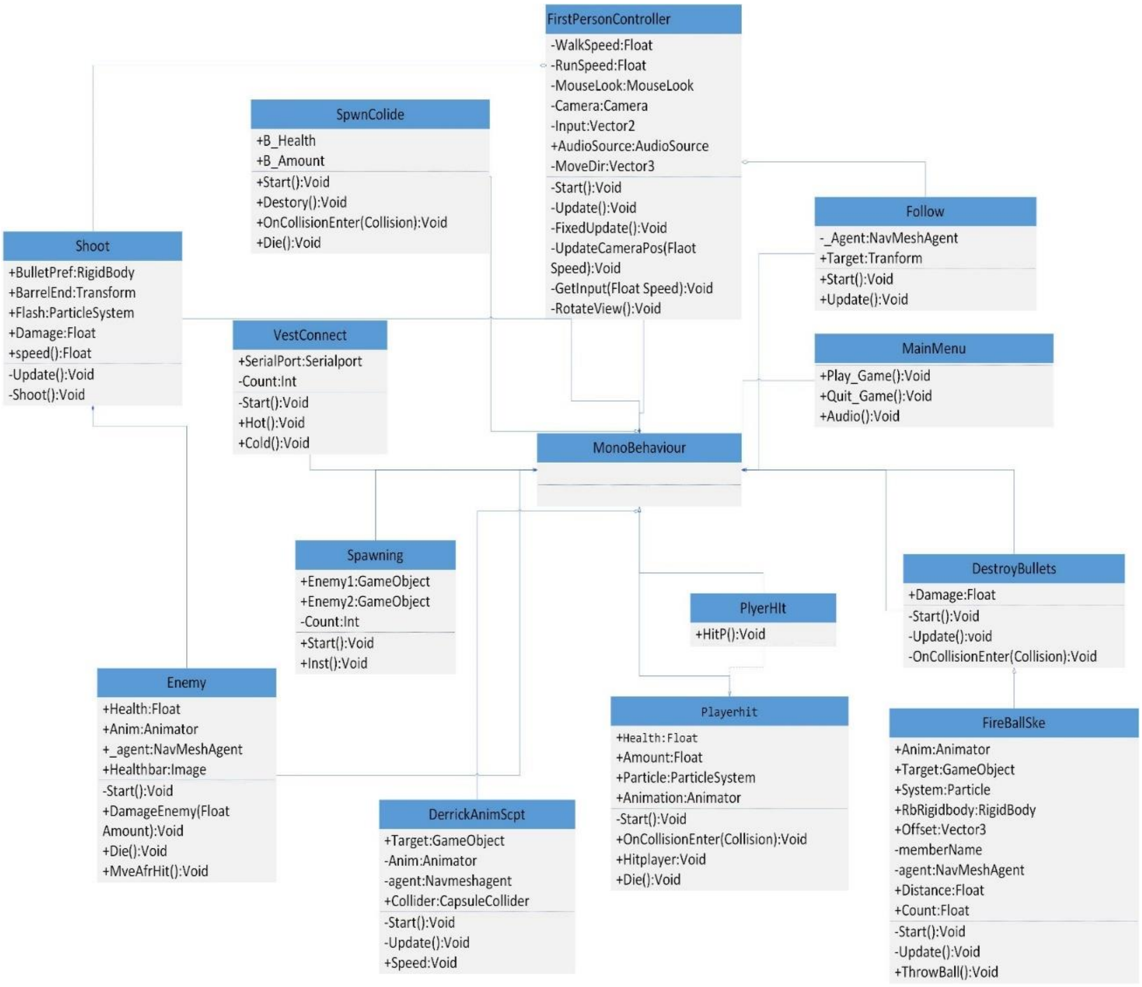


Figure 7: Class Diagram of Quiver VR

3.4.4 Class Table

The table below details each of the classes in the system. This is a high-level description of each class to provide scope and context to the project.

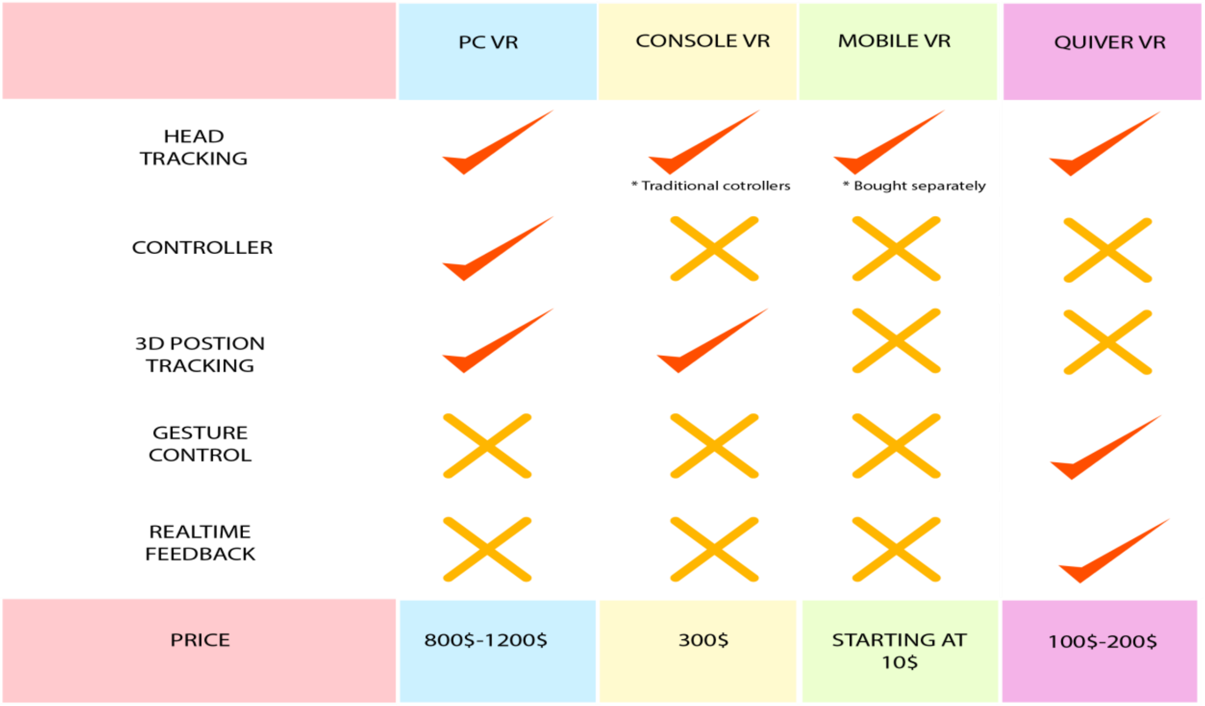
Class	Purpose	Overview
MonoBehaviour	• MonoBehaviour is the base class from which every Unity script derives.	When you use C#, you must explicitly derive from MonoBehaviour. It contains impotent functions for unity.
MainMenu	• Display the menu of the game	MainMenu display the menu and perform functions when menu items clicked.

FirstPersonController	• To Control the movement, position and camera position of the player	The Character Controller is mainly used for third-person or first-person player control.
Shoot	• To shoot from a gun. • To tell information about the hit target. • To play sound and particle effect when gun triggered.	Shoot class have shoot and Update function in it .Update function play the sound and particle effect when gun triggered and shoot function shoots from gun and tell the information of object.
Enemy	• To destroy and reduce the health of enemy.	Enemy class reduce the health of the enemy object and check if its health is zero then it will destroy the enemy.
Spawning	• To create multiple enemies from different places at different time.	Spawning will creates the multiple enemies using the build-in function of monobehaviour and place them in different locations at different time.
Follow	• Make navigation on floor for the enemy. • Use navigation to find specific target.	Follow class make path form the navigation and help enemy to find their target and avoid them from obstacle.
ShootPlayer	• To attack on player. • To play sound and particle effect when enemy hits player	ShootPlayer class have shoot and Update function in it .Update function play the sound and particle effect when enemy hits player and shoot function used to attack player
Feedback Vest	• Generate signal then enemy hits player	Feedback Vest Class Generate signal then enemy hits player and Pass signal from unity to

	- Pass signal from unity to Arduino - Paly specific hardware on the basis of signal	Arduino using bluetooth and Paly specific hardware on the basis of received signal

Table 2: Class Table of the System

3.4.5 Comparison Table



	PC VR	CONSOLE VR	MOBILE VR	QUIVER VR
HEAD TRACKING	✓	✓ * Traditional cotrollers	✓ * Bought separately	✓
CONTROLLER	✓	✗	✗	✗
3D POSTION TRACKING	✓	✓	✗	✗
GESTURE CONTROL	✗	✗	✗	✓
REALTIME FEEDBACK	✗	✗	✗	✓
PRICE	800-1200	300$	STARTING AT 10$	100-200

Table 3: VR headset Comparison Table

3.4.6 Sequence Diagram

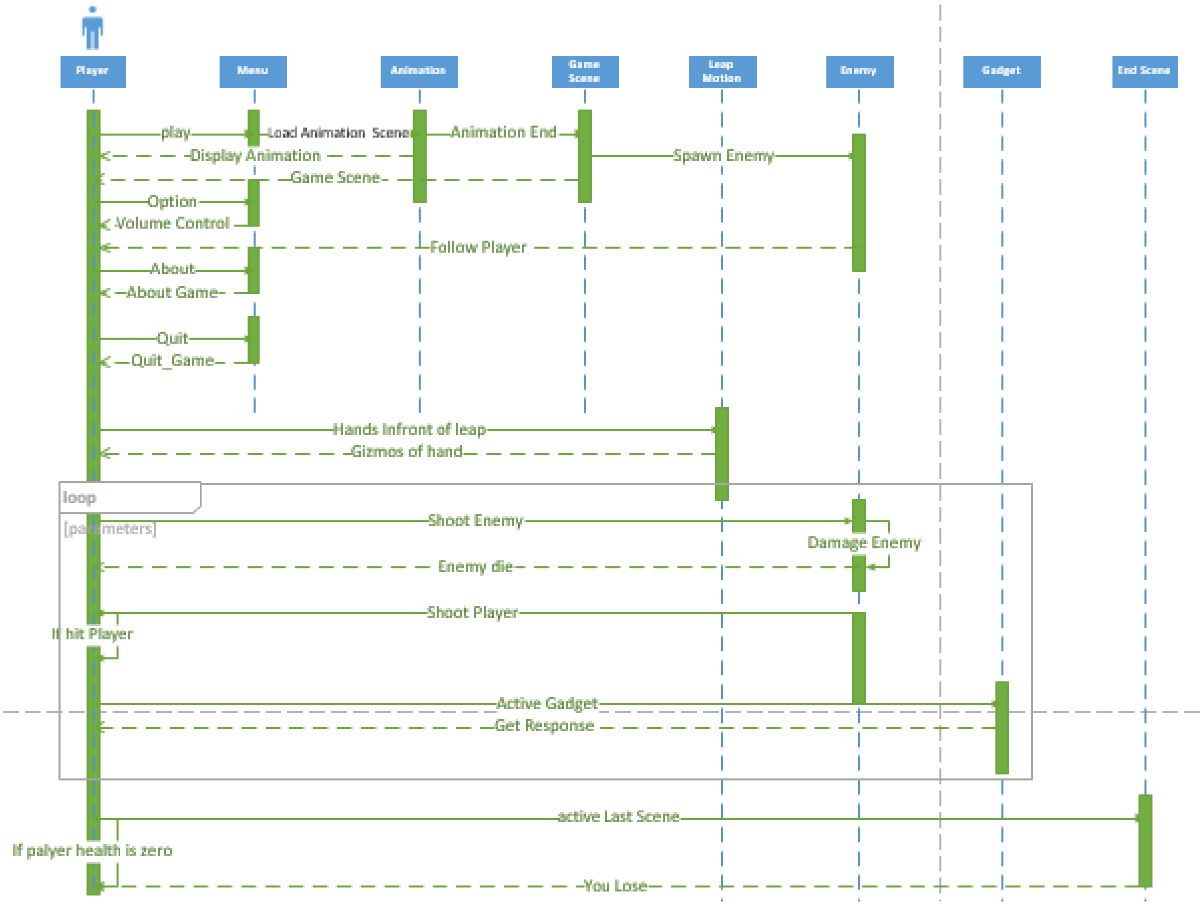


Figure 8: Sequence Diagram of the System

Menu

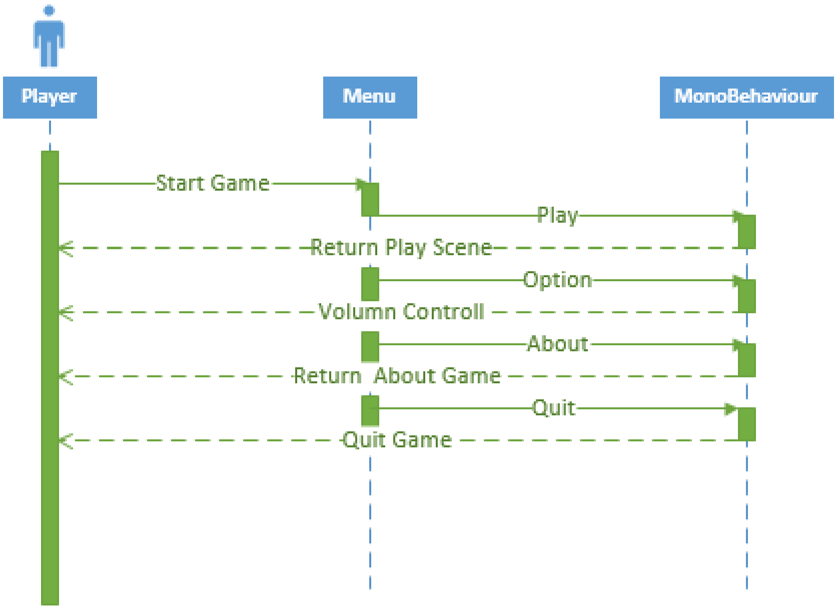


Figure 9: Sequence Diagram of Menu

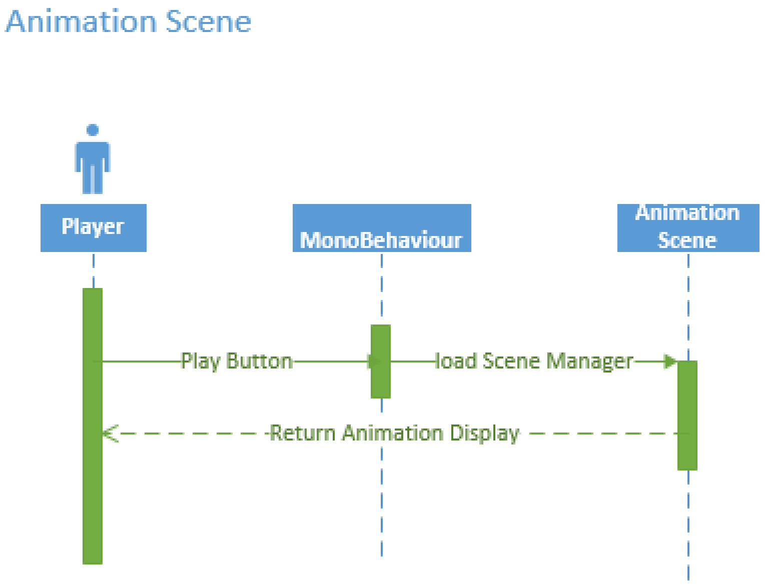


Figure 10: Sequence Diagram of Animation scene

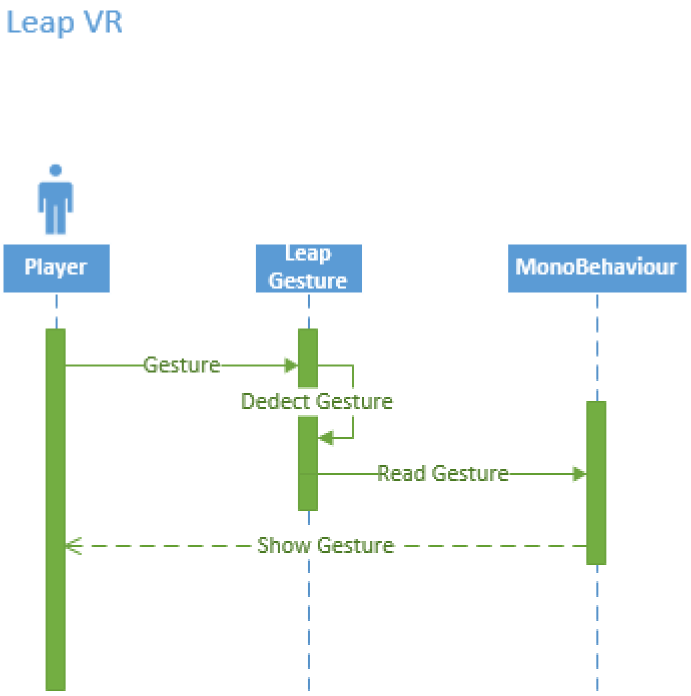


Figure 11: Sequence Diagram of Leap VR

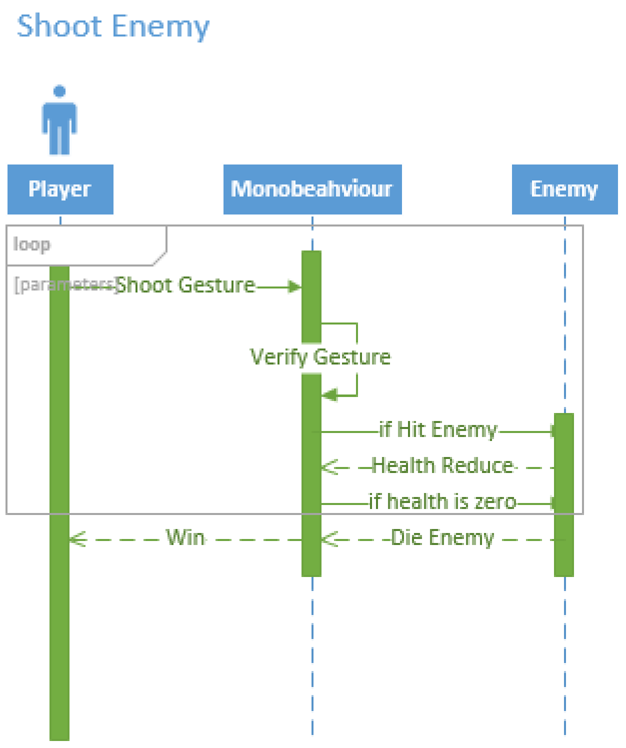


Figure 12: Sequence Diagram of Shooting

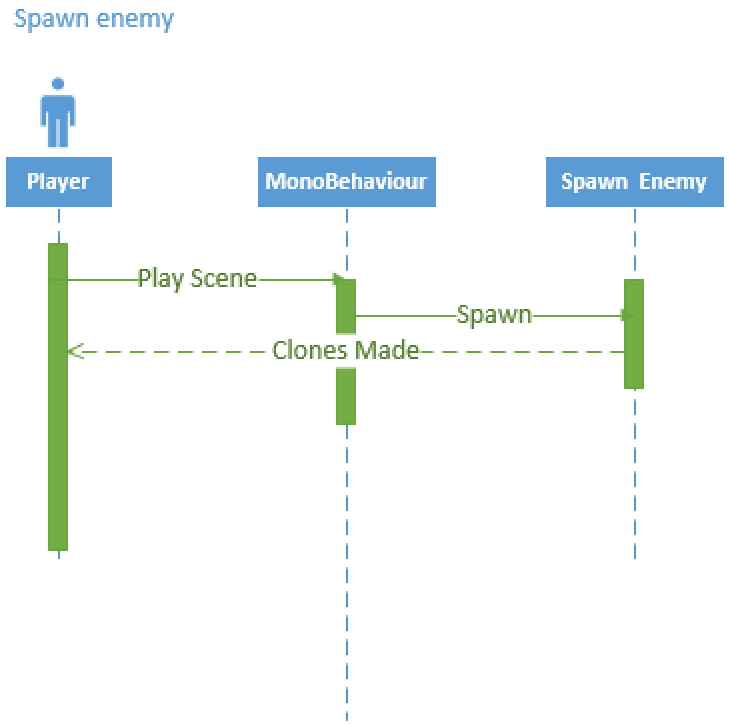


Figure 13: Sequence Diagram of Spawn Enemy

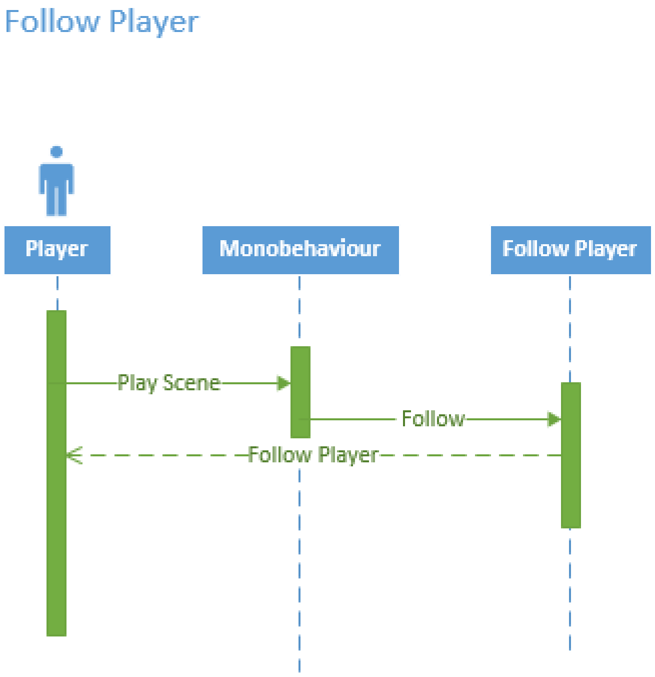


Figure 14: Sequence Diagram of Follow Player

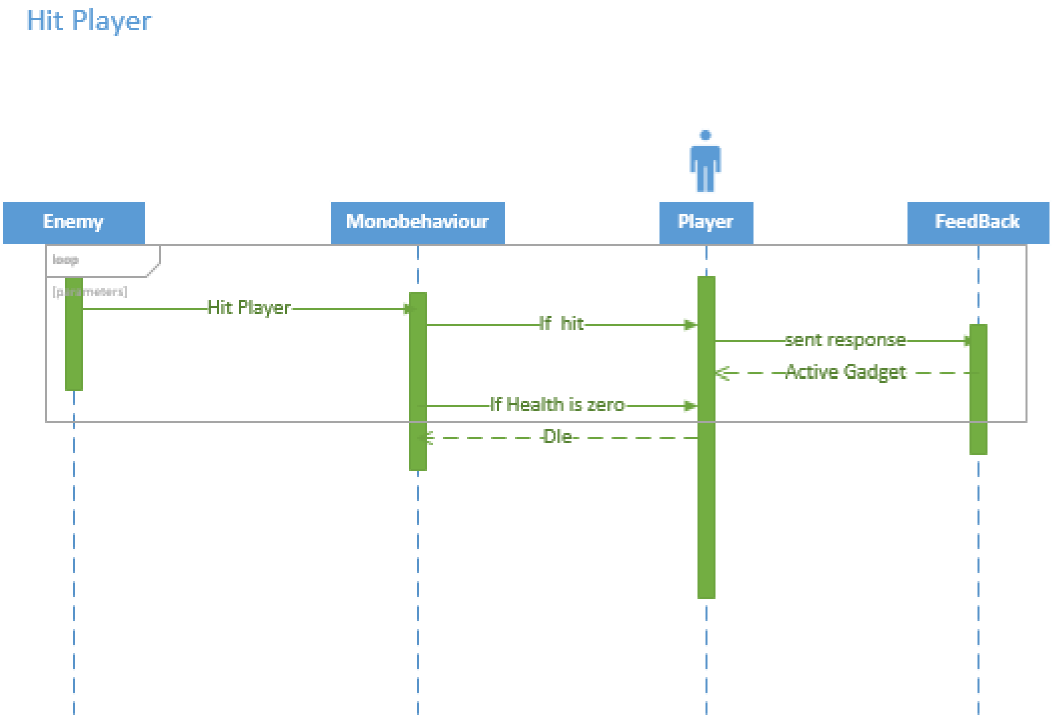


Figure 15: Sequence Diagram of Hit Player

3.4.7 Collaboration Diagram

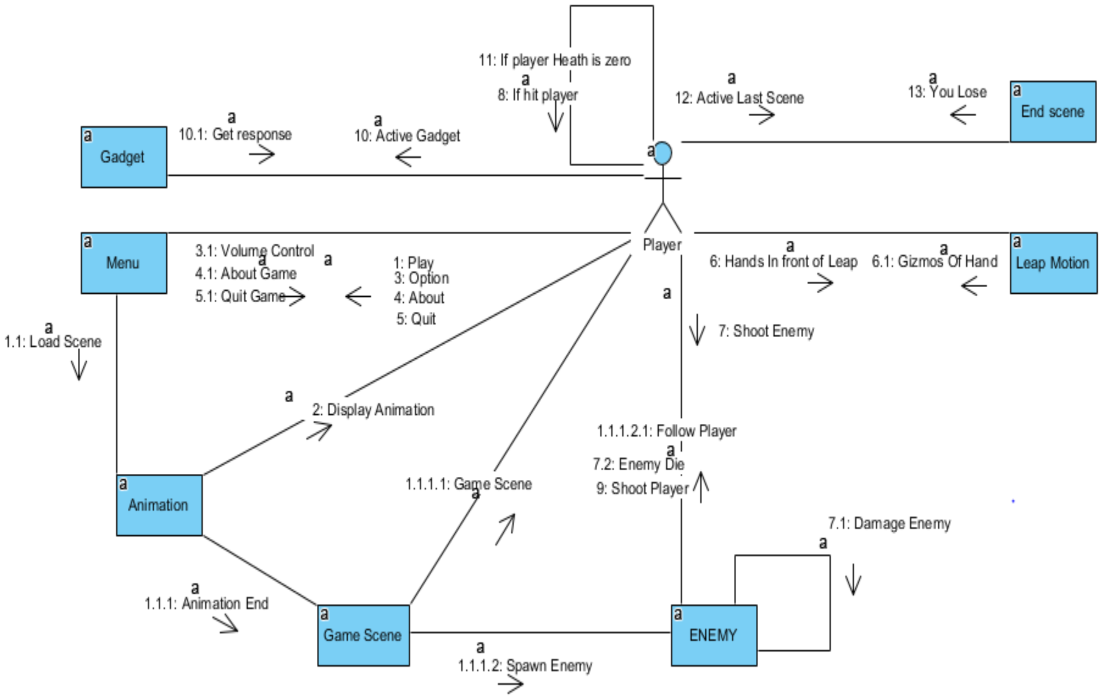


Figure 16: Collaboration Diagram

3.5 Modules

3.5.1 Game Module

Description:

Game module basically depends upon game engine. In this project we used Unity game engine. Unity is a cross-platform game engine developed by Unity Technologies, which is primarily used to develop both three-dimensional and two-dimensional video games. Game engine is a combination of Game Design, Game Animation, Game AI, Game Physics and Sound Manager. From the combination of that components designed goal game is made.

Responsibility:

The responsibility of Game Module is that all components of game engine (Unity) work properly to achieve design game.

Communicates With:

- Communicate with headset
- Communicate with Arduino

3.5.2 Connection Module

Description:

Connection Module is the overall connections of the system from which different components of the system transmit signals and act on it. Connection can be wire and wireless depend on the need of the components.

Responsibility:

The responsibility of Connection Module is that the communication between components should be successful.

Communicates With:

- Communication of leap to pc
- Communication of mobile to pc
- Communication of pc to Arduino

3.5.3 Player Module

Description:

Player Module is module in which player directly or indirectly interact with the system. In this system player communicates with VR, leap motion and feedback gadgets.

Responsibility:

The responsibility is that the communication between system and player should be done properly.

Communicates With:

- Communicate with VR
- Communicate with leap motion.
- Communicate with feedback gadgets.

3.6 Block Diagram

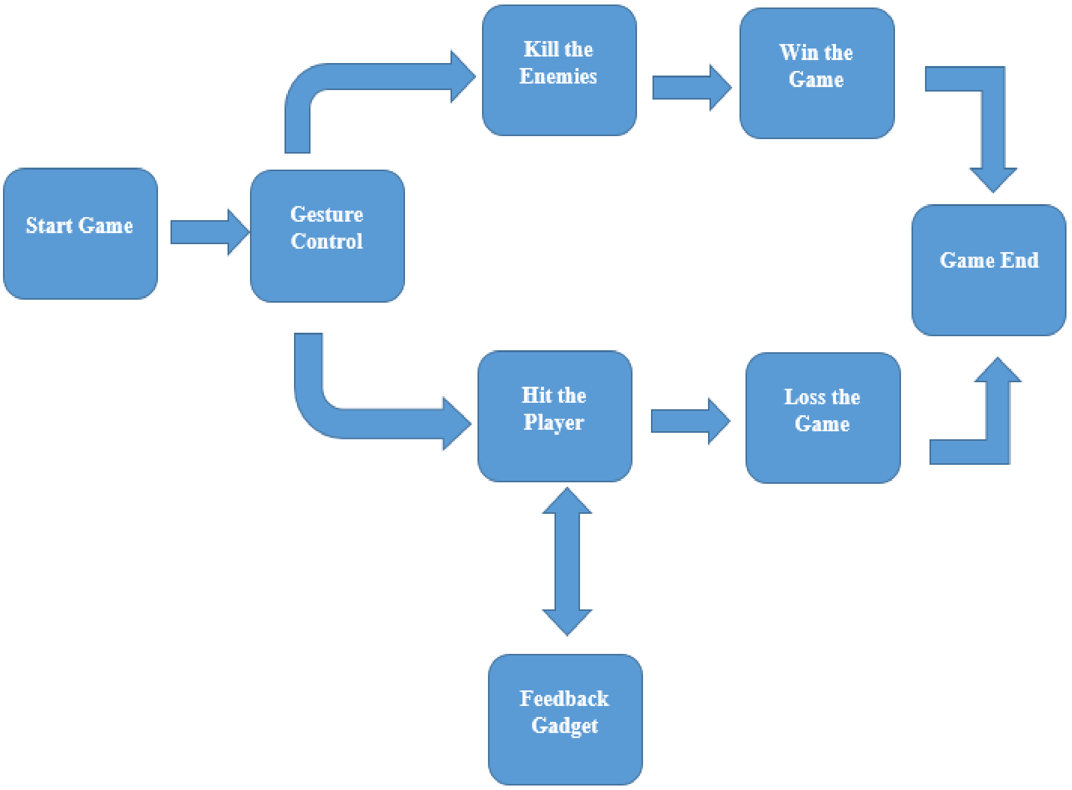


Figure 17: Block Diagram of the System

CHAPTER 4

IMPLEMENTATION

4.1 Implementation

The QUIVER VR is a cluster of hardware and software, combined to achieve the goals efficiently. QUIVER VR development is broken into a four stages. We are adopting Agile development approach using Feature driven development to ensure deadlines and goals are met on time. The development stages are outlined below.

4.1.1 Mobile VR

The first stage of our development process is the development for Mobile VR Headset. Which displays the game view on mobile phone. Mobile VR Headset consists of two parts, one is mobile VR and other is leap motion. SteamVR is install in PC that is a virtual reality system provide 360-degree view. Then mobile is connected to PC through hotspot. The game runs in PC and mobile device acts as a display for the game in VR device using steamVR. Leap motion software is installed in pc that run leap motion device [3]. Leap motion captures the bone structure and joints of hands to trace the position of hand.

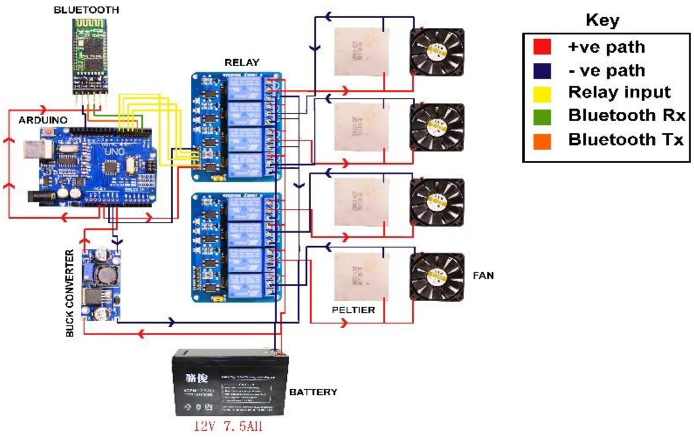
4.1.2 Game Design and Development

The second stage of our development process is the development of FPS Game. The game is developed in unity3d.The game is first person shooter game. In the development of game, first we make the menu interface of the game using unity UI and put functionality in the menu items using scripts and AI. Game environment is made by using Unity 3d objects. Each object has its own physics properties and AI.

To utilize the leap motion gesture in the game we added leap motion package in the unity. Scripts, game AI and physics is used according to the game scenario.

4.1.3 Feedback Gadget Development

The third stage of our development process is the development of Gadgets. Gadgets give real feeling and sensations of the game while it is being played. Different hardware’s are used to meet the specific design gadgets. The interaction between hardware and game is done using bluetooth connection. Coding of the hardware is done by using arduino in C language. Arduino works like a brain of gadgets that will control all hardware parts.



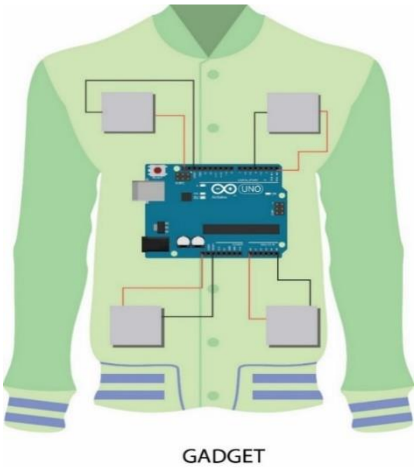


Figure 18: Circuit Diagram of Gadget

Figure 19: Gadget Jacket

4.1.4 Integration

The fourth stage of the development is the integration process. In this stage all the components of system are combined to achieve goal system. Leap VR and arduino are integrated with unity game and test the system work properly. Below diagram explain the overview of the system, how components interact with each other.

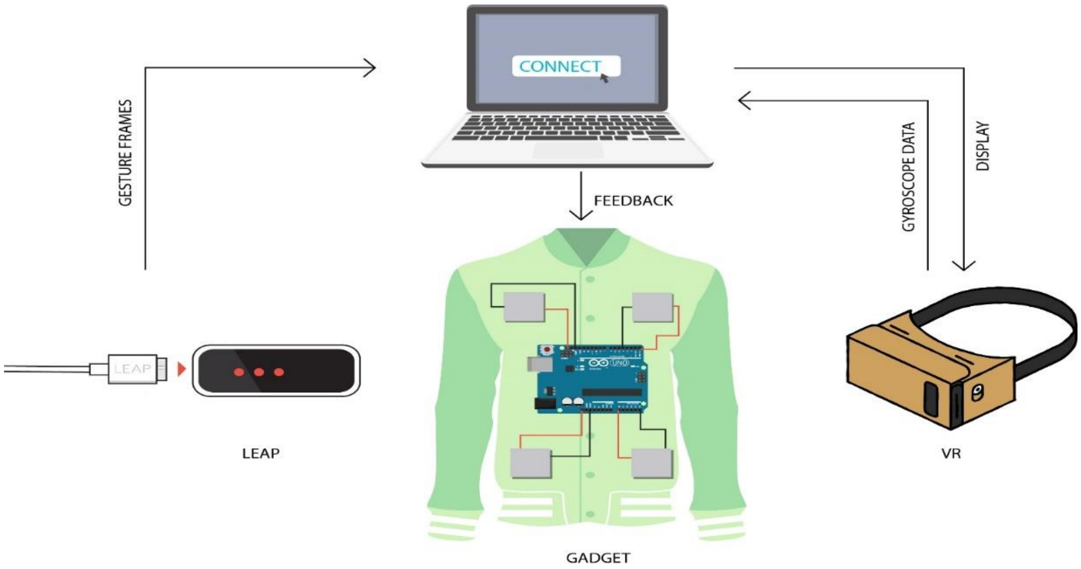


Figure 20: Integration process of System

CHAPTER 5

RESULTS AND USER MANUAL

5.1 Testing

5.1.1 Objective

The testing objectives for the QUIVER VR System are designed to fully realize the specifications of the system. Special care will be taken in the aspects of validation, rigidity, and reliability. The testing procedure will be broken down into various phases and executed at various times within the development process. This allows for a multi-level and multi-view approach to the testing of the system which will provide a superior perspective for detecting bugs and logic errors.

5.1.2 Testing Review

Each module must conform to a list of basic tests. This list is generic enough to apply to all modules, but rigid enough to provide a high-level start to the testing process in an accurate manner. The testing will be divided into the following sections:

1. Unit Testing
2. Integration Testing
3. Functional Testing
4. Performance Evaluation

5.1.3 Unit Testing

Unit testing is the responsibility of the developer. Each module must be tested against a basic list of tests. This verifies that each module satisfies the minimum requirements for it to be accepted into the branch.

Basic Unit Testing List of QUIVER VR:

- Mobile VR connection with pc
- Leap motion connection with pc
- PC compatibility with Unity
- Arduino connection with pc
- Game AI test
- Game Physics test
- Game animation and sound test
- Arduino connection with hardware
- SteamVR compatibility with the system
- VRidge or Rift Cat compatibility with the mobile and the pc

5.1.4 Integration Testing

Integration testing requires that the associated modules be completed and unit tested. Integration testing will verify the integration of the various modules. This requires a review of the unit testing documentation, the long-term requirements, and the standards that apply to the modules.

Basic Integration Testing List of QUIVER VR:

- VRidge in Mobile and Rift Cat in pc communicate properly for transmission of display from pc to mobile
- Leap motion take gesture and transmit it in unity
- Game Components integrate with each other properly
- Arduino communicate with the pc and respond in signals properly
- Communication of Arduino with the other circuits

5.1.5 Performance Evaluation

Performance evaluation will be subject to the module being tested. As with the other testing, the evaluation will start with the testing of the basic performance requirements for all modules.

5.1.6 Test Cases:

5.1.6.1 Mobile VR

Use Case reference: Mobile VR

Test case Name: Mobile VR

Test case Purpose: To ensure that Pc view will be displayed in mobile

Test case Function: To verify that VRidge in Mobile and Rift Cat in pc communicate properly for transmission of display from pc to mobile.

Test case Input: Pc and Mobile are connected to each other through VRidge and Rift Cat.

Test case expected Output: Leap motion will capture and interpret the hand gestures of the player and act accordingly in the game.

Test case Procedure:

Test case input	**Test case output**
Mobile does not have VRidge application and Pc does not have Rift Cat application	The Communication bridge was not established.
Mobile and PC does not connect to each other	The display of the game will not be shown in mobile
All the software's does not run on specific graphic card	The display of the game will not be shown in mobile.
SteamVR office setup was not done	SteamVR does not respond to mobile VR

Table 4: Test Case of Mobile VR

5.1.6.2 Gesture Capture and Interpretation

Use Case reference: Leap Motion

Test case Name: Capture Gesture and interpretation

Test case Purpose: To ensure that Gesture will be displayed in Unity

Test case Function: To verify that leap motion will capture and interpret the hand gestures of the player and act accordingly in the game.

Test case Input: Pc and Leap Motion are connected to each other through wire.

Test case expected Output: The game will run in PC and mobile device will act as a display for the game in VR device.

Test case Procedure:

Test case input	**Test case output**
Leap Motion software does not install in pc	Leap Motion will not work.
When the hand is at parallel with Leap Motion sensors	Leap motion fails to perform well
When hand is out of leap motion range	Leap Motion fails to capture gesture

Table 5: Gesture Capture and interpretation

5.1.6.3 Menu Testing

Use Case reference: Game Start

Test case Name: Menu Testing

Test case Purpose: To ensure that Menu display work properly

Test case Function: To verify that each method in Menu works properly.

Test case Input: Game started.

Test case expected Output: The player will select the desired menu option.

Test case Procedure:

Test case input	**Test case output**
Player points towards the desire option	Desired option will be highlighted
Player push’s the trigger for selection	Desired Menu option will be opened.

Table 6: Test Case for Menu

5.2 Introduction

Quiver VR allows you to experience VR gaming to an affordable prize. The use of hefty PC gaming VR is replaced with smart and easily accessible mobile VR (headset). Instead of carrying a controllers for performing any action in game, real time gestures is used for that purpose. Uniquely designed gadgets gives real feeling and sensations of the game while it is being played. The player not only give input to the game but also get feedback from the virtual world. This make a two-way interaction between the player in reality and the virtual game environment. The game is first person shooter game in which the world is effected by T-virus and everyone was converting into zombies. The player is a soldier of army and his plane was crashed in Atlantic Ocean and here start the survival game of zombies.

5.3 System Requirements

- 4th gen Intel Core i5
- 8gb ram
- nVidia 940mx graphic card(4gb)
- Android Mobile phone with gyroscope

5.4 Install Instructions

To install the VR game, first download the Quiver VR or insert the CD of it into your CR-ROM drive and click on the install button it will open the installation wizard. Wizard tell us about the game and location on which game will install then click on install button. Game will be installed.

5.5 How to play

1. Set up VR Headset

To play the VR game it is necessary to set up your Mobile VR and Jacket. First download the Rift Cat application in your desktop and VRidge Application in your Mobile phone. Connect both of the Applications through Any communication medium for the display of the desktop game in mobile screen. Then put your mobile phone into your headset to enter in the world of virtuality.

2. Set Up Jacket

Set up your jacket for real feeling and sensations of the game. First on the power button of the jacket so, you can connect your jacket to your desktop game. Then enable Bluetooth of your desktop and connect it from the jacket.

3. Instruction of Game

To get the better experience of the Quiver VR run game on your Graphic Card (GPU).

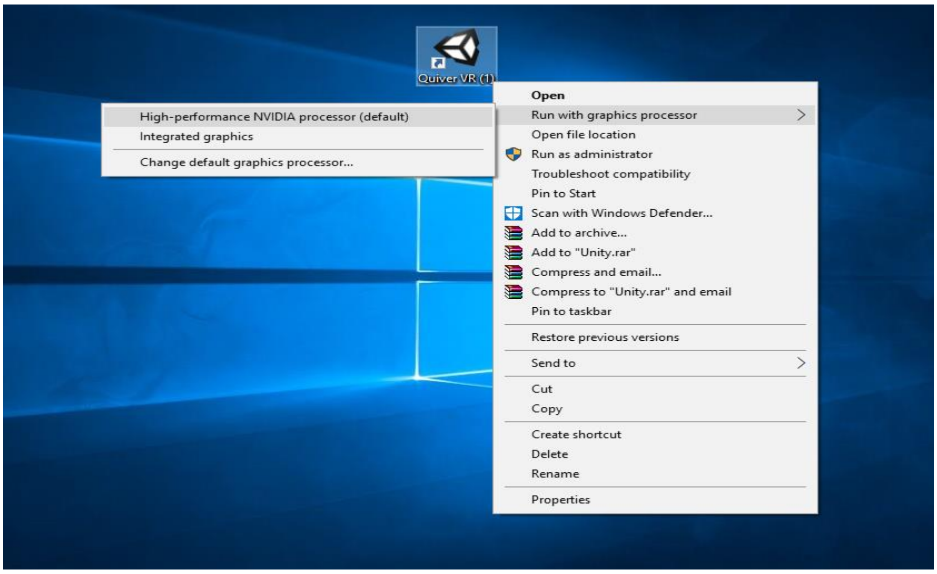

Quiver VR (1)
High-performance NVIDIA processor (default)
Integrated graphics
Change default graphics processor...
Open
Run with graphics processor
Open file location
Run as administrator
Troubleshoot compatibility
Pin to Start
Scan with Windows Defender...
Add to archive...
Add to "Unity.rar"
Compress and email...
Compress to "Unity.rar" and email
Pin to taskbar
Restore previous versions
Send to
Cut
Copy
Create shortcut
Delete
Rename
Properties

Figure 21: Selection of GPU processor

When game will run it will open the menu scene of the game. Which have different options of game like Play, Volume, About and Quiet. Each option have its own functionality To Access these options to need to open your right hand. When you open your hand a menu will pop up besides your hand

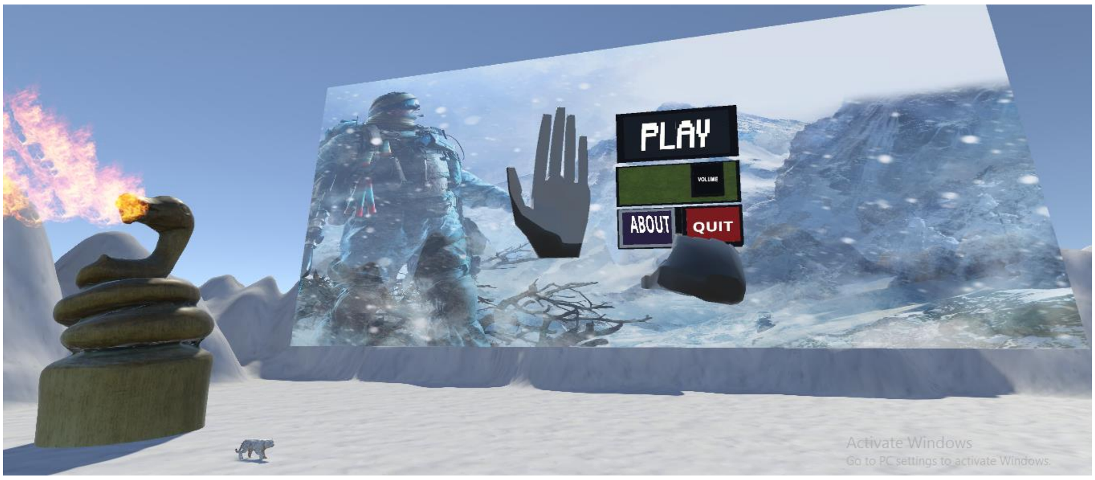


Figure 22: Menu Of the game

To play the game click on the PLAY button by moving your left hand towards the play button.

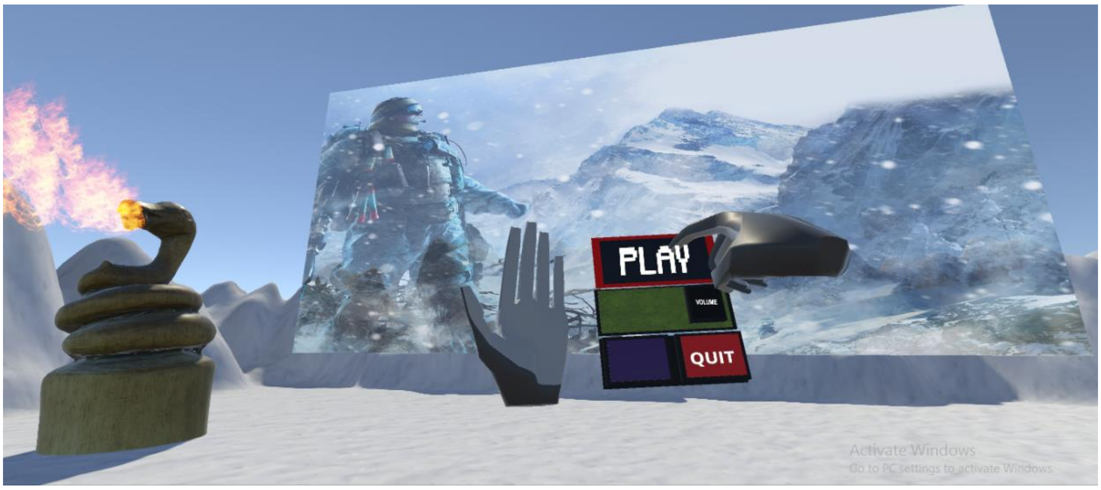


Figure 23: Clicking on Play button

To increase and decrease the game volume click on the VOLUME button by moving your left hand towards the volume button.

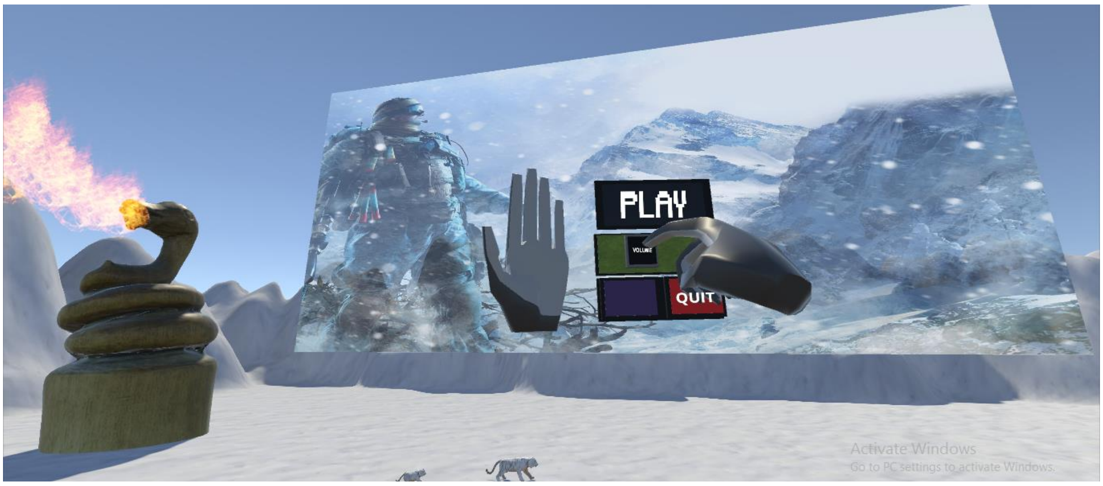


Figure 24: Sliding Volume Control

To get detail about the Quiver click on the ABOUT button by moving your left hand towards the about button

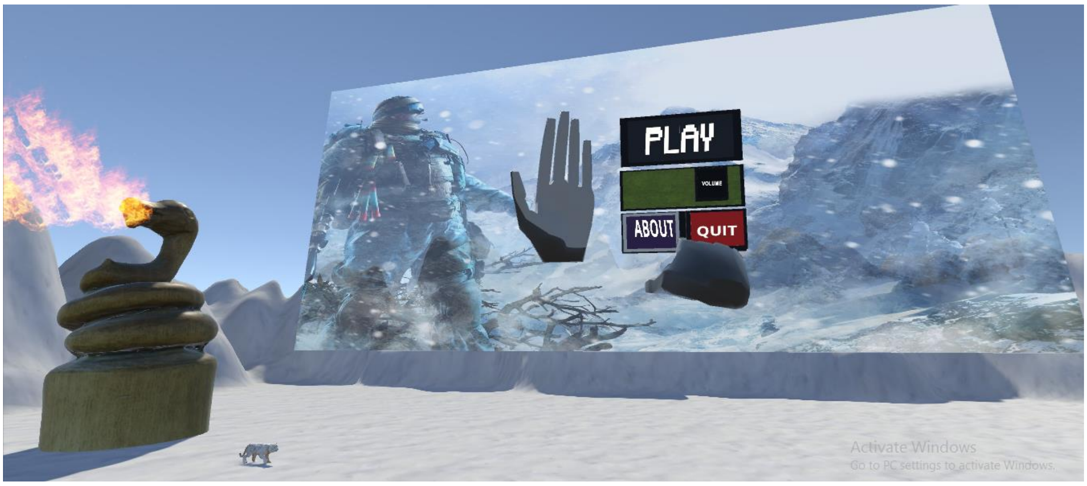


Figure 25: Clicking About button.

To quit the game click on the QUIT button by moving your left hand towards the quit button

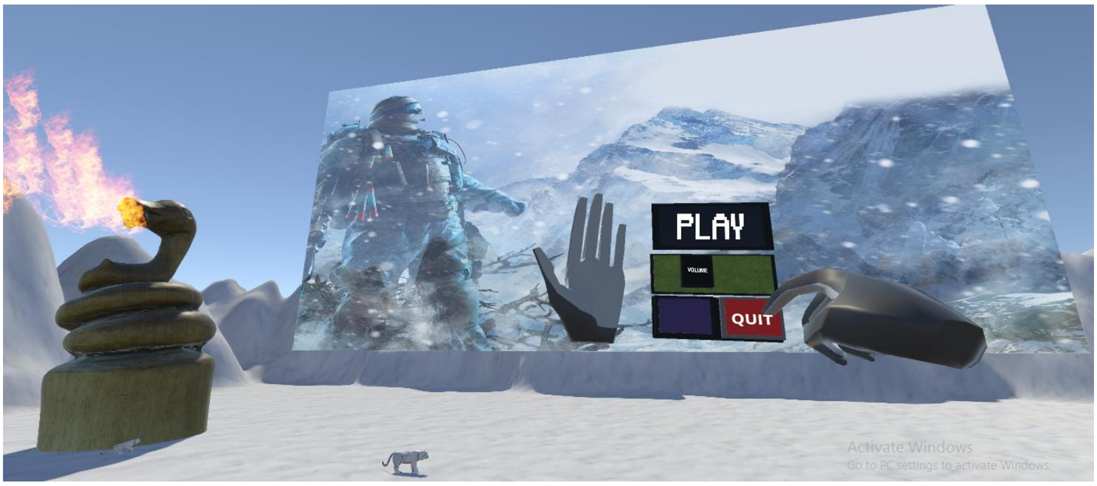


Figure 26: Clicking Quit button

By clicking on the play button the game scene will start and after some time zombie will come towards you, to kill the zombie you need to fire the gun on your right hand by doing the shoot sign from your hand in real time.

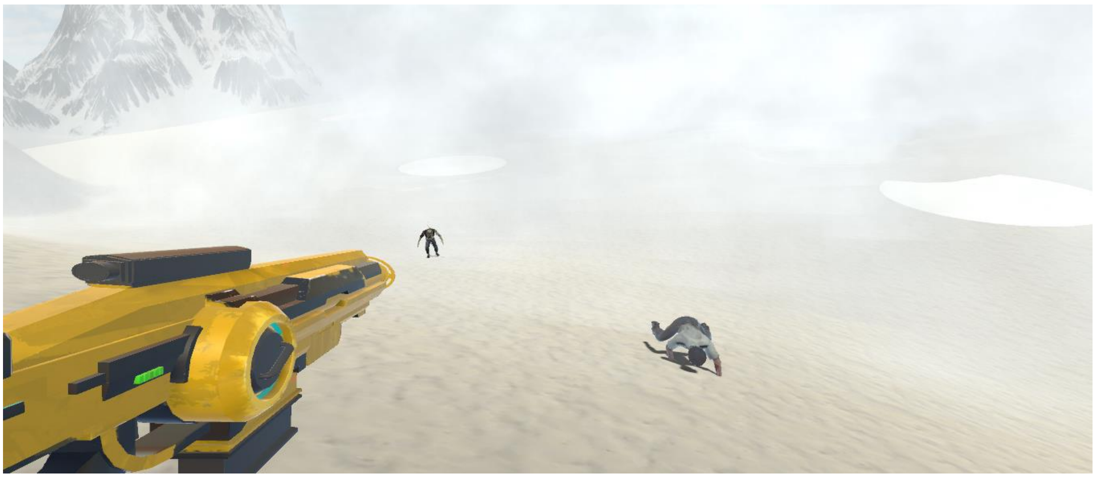


Figure 27: Shooting enemy

5.6 Technical Support

Technical support E-mail: ammardar58@gmail.com

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This project involved the implementation of virtual reality in an action game controlled by user gestures. The game runs as a PC application and transmits its display to a android mobile phone where the game interface is displayed in VR mode. The mobile is inserted in a virtual reality headset for view.

The game is played by users hand gestures captured by a device called Leap Motion. Leap motion sends the gesture data to PC application where they are used to trigger actions in the game.

A feedback jacket worn by player gives real sensations of the environment and actions in the game. This jacket wirelessly connects with the PC game and responses according to scenarios in the game.

All this system is performing exceptionally well. The virtual experience as well as the feedback gadget combined serves as an adrenaline injection to boost up the excitement and adventure of the player.

6.2 Recommendations

As per our recommendations, motion tracking in 3D space can serve as a great feature for the project. The player will also be able to move around in the game as he moves in the real world. Additionally, an alternate solution for gesture capturing which is wireless enabled will be better as the player will not have to stay close to PC and could move freely around.

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