

Learning Aim:

Its a Game



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Abstract

According to our research, we have seen that there is not much done by the PC applications in the world of Biomedical engineering. Nowadays, gaming is very common and there is a lot of work going on this field. Project is about a 3D game. We have used Unity engine and C# language to make it possible. Displaying equipment is the main asset to help the gamer learn about it. Video games are being developed now and then and people are showing great interest in it. Games are not only for entertaining purposes but also help you learn.

The project aims to provide knowledge about different equipment of biomedical engineering. The project comes with different strategies to help the gamer learn including displaying the equipment in the bubble and asking the name of the equipment from the user or finding an equipment in a 3D designed room.

The project also comes with a section of learning portal in which gamer will be able to learn about the name of equipment, purpose of equipment and details of equipment.

This game will help the people in practical life of biomedical engineering and they will be able to recognize different equipment.

Acknowledgements

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“ We think someone else, someone smarter than us, someone more capable, Someone with more resources will solve that problem. But there isn’t anyone else.”

Regina E. Dugan

Abbreviation and Acronyms

3D	3 dimensional
BME	Bio Medical Engineering
ERD	Entity Relationship Diagram
FTE	Find the Equipment
GE	Guess Equipment
GUI	Graphical User Interface
LA	Learning Aim
LP	Learning Portal
UML	Unified Modeling Language
WHO	World Health Organization

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Chapter 1: Project Overview

1 Project Overview

1.1 Project Background/Overview

1.1.1 Introduction

As technology advances, learning through desktop applications has become a trend in educational field. Due to pandemic situation in the past two years, people are more inclined towards educating themselves at home through the medium of technology i.e., mobiles phones, laptops etc.

These huge changes in education field have led us to develop a game in which a user can use computer input system to direct the game and experience 3D world in context of Biomedical Engineering Field.

Our game will introduce different modes for Biomedical Engineers where they can learn how an equipment work, purpose of equipment, information about multiple equipment, etc. The game will aware and educate people in the field of Biomedical Engineering. It is equally helpful for Biomedical Engineers to familiarized themselves with this field.

(a) Aims

- To make students an enthusiastic learner
- To motivate and engage students
- Getting rid of uninteresting/boring learning methods
- To help students with focus and memory
- To make students an improved learner

(b) Roles of games in Education

Boyle in 2009 said that games play major role in supporting learning and behaviour change [1]. As an educational tool, games lead towards a constructive way of learning and building interest as they engage students to participate.

(c) Problem Solving and rule following skills

Every game is based on some rules which players are required to follow to achieve the success and move towards next stages. Students can easily apply this knowledge in the real world as they are encouraged to think outside the box.

(d) Computer and Visual Literacy

In this century, we live in a world which is ruled by technology and innovation. Through games, students are able to experience computer and visual literacy which will be useful for them in the world of work.

1.2 Problem Description



Figure 1.2.0: Problem Description

Biomedical Engineering is a relatively newer field in Pakistan as compared to other engineering fields. This enables the lack of awareness of the field among the students and parents. There is only one university in Islamabad and one in Punjab offering this program. As the fig 1.2.0 shows that the density of Biomedical Engineers per 10,000 population globally in 2017 through survey launch by WHO between universities offering BME programs [2].

1.3 Project Objectives

According to our research, there are no Biomedical Engineering structured learning game available in Pakistan or elsewhere right now. Therefore, we developed an application that will help students to learn in a more interactive and creative environment. Our core objective is to promote education of biomedical engineering among enrolled students and to provide them the knowledge of latest technologies in the field.

It is equally fruitful for those who want to pursue their career in Biomedical Engineering field. Moreover, it will help current biomedical engineers to relax from their work and play the games for entertainment purposes.

1.4 Project Scope

Scope of biomedical engineering is growing in Pakistan. Number of job opportunities is relatively less. But with the advancements in the profession in Pakistan, new hospitals and diagnostic laboratories being built in every city of Pakistan, the demand of the innovative tools, technology and machinery is increasing day by day which will increase the opportunities for bio-medical engineers.

The project will help bio-medical students in learning about different equipment and construct their knowledge through out the game experience. This project also introduces learning through games which can be implemented in

various fields.

1.5 Tools and Technology

For the course of this project, we will use:

- Blender
- Substance 3D
- Unity 3D
- Unity Grid tools
- Unity Pro Builder
- Unity Input System
- Unity Particle System
- Visual Studio
- C#
- Adobe Photo-shop
- Adobe Illustrator

Chapter 2: Literature Review

2 Literature Review

2.1 Literature Review

According to Marián Alesón-Carbonell and Victoria Guillen Nieto, the benefits of playing games in perspective of education is undeniable. The learning effectiveness by playing games leads to engage learners and the learning outcome can be achieved through playing games [3].

Charsky portrays that how games can be super helpful for education purposes and how it can entertain the learners [4].

There are many complexities and difficulties involved in this game that can be used to enhance the gamer experience and to provide them efficient learning. The Learning Aim will help the students to get a learning environment where they will be able to get different knowledge about equipment. There is currently no game which helps a biomedical student to get knowledge about different equipment. The student will experience different games like guessing equipment name, knowledge and working of equipment, knowledge of different types of equipment and visual representation of equipment. The ultimate goal to develop educational game is to recreate a motivation in students to learn.

In any case, the application of learning theories in higher education has an impact on student performance. According to (Ben-Ari, 1998), Constructivism is a theory that states that students construct knowledge rather than merely receive and store knowledge conveyed by teacher. It has an extremely influential in science and mathematics education [5].

2.1.1 Instructional Design

Instructional design is the part where we clear the goals of our game. The goals are:

- Our audiences? Qualities of learners or students
- What are the outcomes for the students by playing the game? Goals
- How to manage the learning process? Instructional techniques
- How to decide the outcome/degree of learning of the student? Assessment techniques

2.1.2 E-Gaming

E-gaming also known as Electronic gaming has expanded at a very rapid rate recently. It has able to capture the attention of people of all ages and has been proved very entertaining and thrilling. Nowadays games are developed belonging to different genres, such as sports, puzzle, action, strategy, learning etc [6].

2.1.3 Game-Based Learning

Game-based learning games are the games which are developed keeping academics and teaching techniques as their core part. People tend to learn more easily and engagingly through interactive gaming techniques when they are calm and relaxed. An experiment was performed by National University of Tainan, Taiwan and Cheng Shiu University, Kaoshiung, Taiwan. Forty two students participated in this experiment in which half of the students were provided a game-based learning environment to prepare for a test and half were not. It was proved that the students with game-based learning environment performed much better than the other half on an average [7].

2.2 Games in Education

Without a doubt it was proved that games have an immense effect on the user which led to catch an eye of the researchers over the past decade therefore if games are developed for educational purposes, users would learn concepts more effectively. Game based learning is the field related to study of such sorts. [8]

2.3 Related Work

The games which are learning based games are mentioned in related work. These game provide information related to their respective fields but they don't follow a learning method that provide ease to the user.

2.3.1 Want to be a Biomedical Engineer?

There is an application named "Want to be a Bio Engineer?" for Biomedical Engineers that is based on MCQ's. The game follows very boring method and it is not engaging as well as shown in Fig 2.3.1.

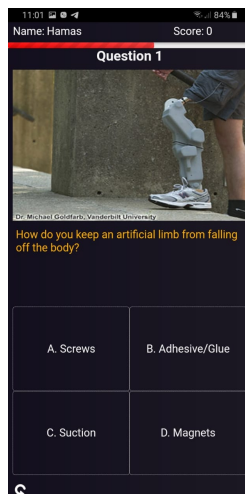


Figure 2.3.1: Gameplay of Want to be a Biomedical Engineer?

2.3.2 Edabit

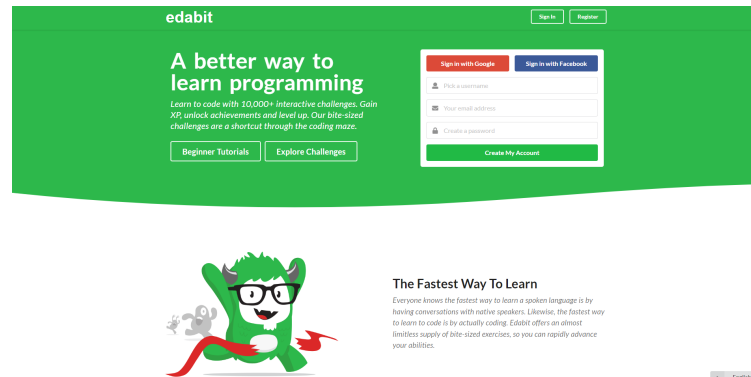


Figure 2.3.2: Interface of Edabit

Edabit is an online game that helps the students learn about programming as shown in Fig 2.3.2. There are different challenges which a student has to complete. When the student completes a challenge, he gets XPs as a reward. Student can also see the codes of other people after completion. The main drawback of Edabit is that, it not very engaging to student. It is just like learning from an online course.

2.3.3 Arcademics Games



Figure 2.3.3: Interface of Arcademics Games

It is an online learning website for playing educational games as shown in Figure 2.3.3. It uses challenges and immediate corrective feedback. The website is only for the students who want to learn general knowledge and it has mainly children based games.

Chapter 3: Requirement Specification

3 Requirement Specification

3.1 Requirement Specification

3.1.1 Existing System

As there is no proper advanced existing system or game that is designed for Biomedical Engineering students. There are some online learning material from where students can learn about different equipment or its working but there is no game that will help them learn in an engaging way in context of biomedical engineering.

3.1.2 Proposed System

The game "Learning Aim" is designed in such a way that students of Biomedical engineering will develop interest in their respective field impulsively. There are two options for the gamer in this game.

- (a) Modes of Game
- (b) Learning Portal

Modes of Game

There are different modes of game to engage the students of biomedical engineers. Each mode has a specific way to help the student learn about the different equipment and working of the equipment. These modes are designed to develop interest for the students and to eliminate the boredom. These modes include guessing the equipment name, popping an equipment from a bubble and finding the hidden equipment. When the player guesses the right name of the equipment, scores are added in the scoreboard which offer more interest to the player and curiosity to play and learn more.

Learning Portal

Learning Portal is designed for the ease of gamer to learn and get knowledge of different equipment regarding biomedical engineering. By selecting learning portal, an interface will appear with multiple equipment along with the name. Gamer can select that equipment and all the information regarding the equipment will pop up i.e., name of equipment, purpose of equipment etc.

3.1.3 Requirement Specification

Requirement specification is a supreme part of a project. This is because requirement specification establishes and clarifies the operations, performance, efficiency and interface quality assurance of the system. The document narrates a detailed description of functional as well as non-functional requirements.

3.1.4 Purpose of document

The document entails all the working of the system such as how the system will work, what are the constraints on which it will run. It also describes the specifications, functional and non-functional requirements.

3.1.5 Functional Requirement

The requirements which define the main functions of the product and functionality of a product on which it will work are the functional requirements. These are the necessary requirements of the product on which the game is working. The functional requirements are as follow:

- (a) **Registering a Player**
Game will allow the user to have his own profile in which he will be able to register his name and other information.
- (b) **Game Menu**
Game will have a menu through which player will be able to select weather he wants to play the game or get knowledge of different equipment through learning portal.
- (c) **Game Modes**
There will be different games to develop more interest of the player.
- (d) **Learning Portal**
Learning portal will offer knowledge of different and latest equipment through which player will be able to learn.
- (e) **Difficulty**
Game have modes of difficulties i.e., easy, medium or hard. Player will be able to choose the difficulty according to his desire.
- (f) **Score Board**
Score board will display scores of the player according to his gaming skills.
- (g) **Pausing**
Game will allow the user to pause the game so that if he is interrupted by something he can pause the game and resume it later.
- (h) **Environments**
Gamer will encounter different environment to enhance his gaming and learning experience.
- (i) **Playing Criteria**
The game will allow the gamer to play only one game at a time.
- (j) **Timer**
Game will offer the gamer to complete his game in a given time period.

3.1.6 Non-Functional Requirements

The requirements which enhance the usability and performance of the system are the non-functional requirements. Non-functional requirements are not necessary but is it quite useful to perform the main functionality. The non functional requirements are as follow:

- (a) **Usability**
The interface is designed in such a way that it looks attractive to the gamer along with appropriate colour scheme to improve the usability of the system
- (b) **Performance**
The game will process all the information in time and it will not crash.
- (c) **User Experience**
Game offers a fun experience for user.
- (d) **Durability**
Bugs should be as low as possible in the game to enhance its durability.
- (e) **Sound**
Game will produce sounds when certain activity is performed.

3.1.7 Use Case Diagram

Use case diagram generally allows to summarize the details of the system and the users within. Common components of Use case includes:

- **Use cases:** Horizontally shaped ovals that represent the different uses that a user might have.
- **Actors:** Figures that represent the people actually employing the use cases.
- **Associations:** A line between actors and use cases. In complex diagrams, it is important to know which actors are associated with which use cases.
- **System boundary boxes:** A box that sets a system scope to use cases. All use cases outside the box would be considered outside the scope of that system.

3.1.7.1: Use Case Diagram of Learning Aim

Fig 3.1.7.1 describes the use case diagram of the overall system of Learning Aim. The player acts as an actor in the diagram which is interacting with the system. The use cases in this system are "Register", "Select Game", "Learning Portal", "View Profile" and "Quit". These use cases are further described in Table 1, Table 2, Table 3, Table 4 and Table 5.

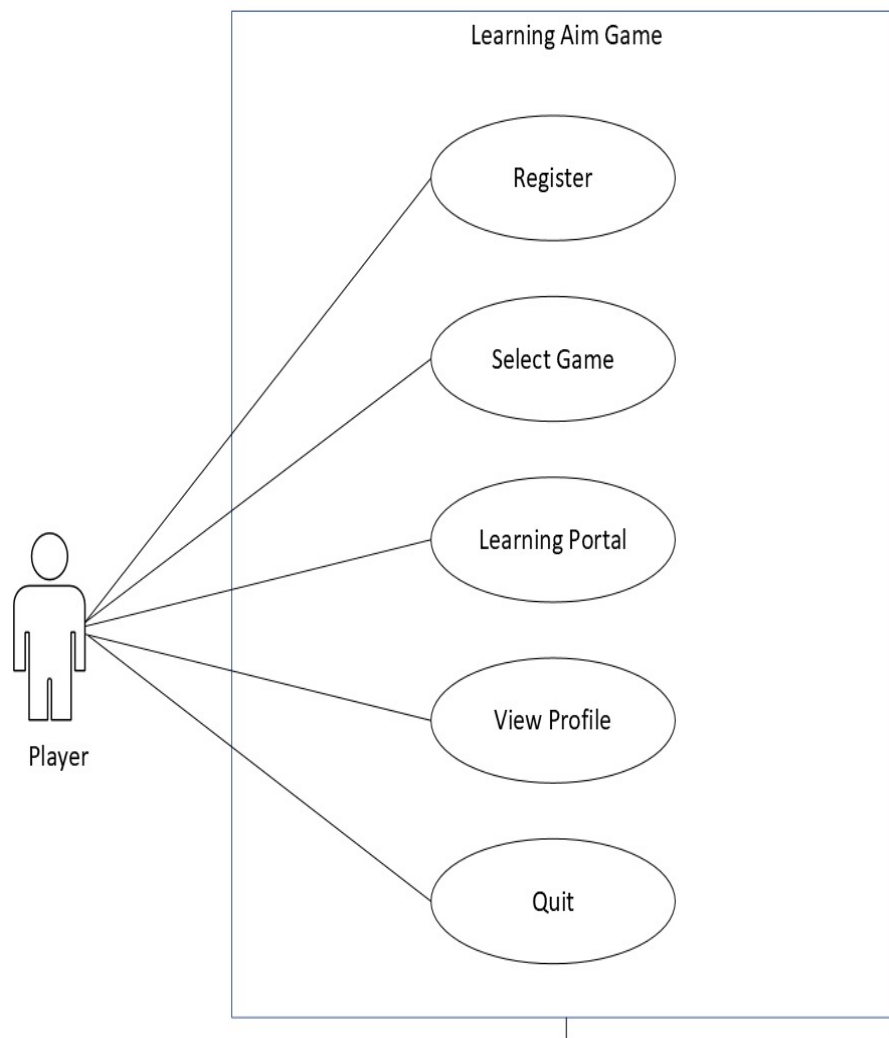


Figure 3.1.7.1: Use case Diagram of Learning Aim

Table 1: Use Case 1 of Learning Aim Game

Use Case ID	UC01
Use Case Name	Register
Scope	Learning Aim Game
Level	User
Primary Actor	Player
Pre-conditions	User must open the game
Post-conditions	Name should be register in the database
Main success scenario	The profile of player will be created.

Table 2: Use Case 2 of Learning Aim Game

Use Case ID	UC02
Use Case Name	Menu
Scope	Learning Aim Game
Level	User
Primary Actor	Player
Pre-conditions	Player must be registered before menu pop up.
Post-conditions	Player will be able to select the game he wants or play or hop into learning portal.
Main success scenario	<ul style="list-style-type: none"> ▪ Player must be able to select the game he wants to play. ▪ Player must be able to select the learning portal option.

Table 3: Use Case 3 of Learning Aim Game

Use Case ID	UC-03
Use Case Name	Select game
Scope	Learning Aim Game
Level	User
Primary Actor	Player
Pre-conditions	Player must select it from the menu.
Post-conditions	Player should be able to play the game he selected.
Main success scenario	<ul style="list-style-type: none"> ▪ Player should be able to play the game. ▪ Player should get different modes of game.

Table 4: Use Case 4 of Learning Aim Game

Use Case ID	UC-04
Use Case Name	Learning Portal
Scope	Learning Aim Game
Level	User
Primary Actor	Player
Pre-conditions	Player must select it from the menu.
Post-conditions	Player should be able to enter the learning portal.
Main success scenario	<ul style="list-style-type: none"> ▪ Player should be able to learn about different information and working of the equipment.

Table 5: Use Case 5 of Learning Aim Game

Use Case ID	UC-05
Use Case Name	View Profile
Scope	Learning Aim Game
Level	User
Primary Actor	Player
Pre-conditions	Player must register the profile.
Post-conditions	Player should get his profile information.
Main success scenario	<ul style="list-style-type: none">▪ Player should be able to get all his profile information.

3.1.7.2: Use Case Diagram of Find the Equipment

Fig 3.1.7.2 describes the use case diagram of Find the Equipment of the game. The player acts as an actor in the diagram which is interacting with the system. The use cases in this system are "Start Game", "Pause/Resume", "Find the Equipment", "Place in Correct Spot", "Update Score" and "Exit". The 'extend' is for adding methods to the class but not to its instance. These use cases are further described in Table 6, Table 7, Table 8, Table 9 and Table 10.

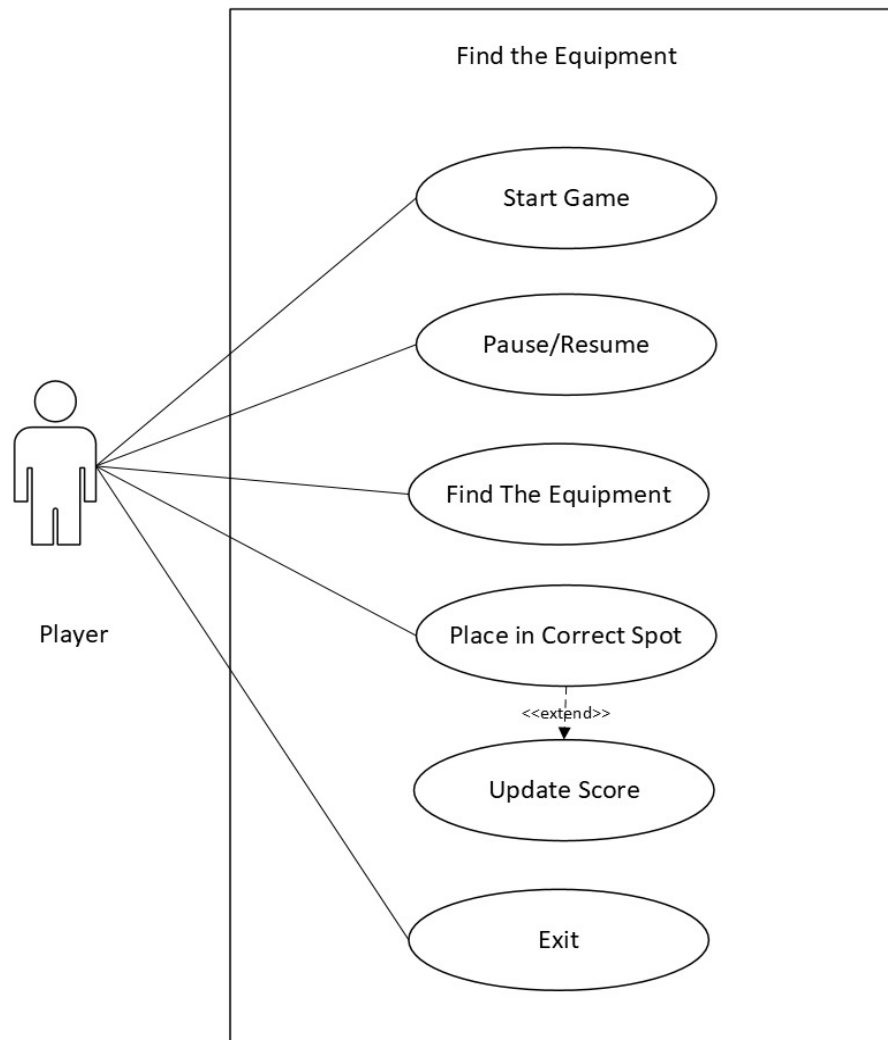


Figure 3.1.7.2: Use case Diagram of Find the Equipment

Table 6: Use Case 6 of Find the Equipment

Use Case ID	UC-06
Use Case Name	Start
Scope	Find the Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player Should select this game from the "Select game" menu.
Post-conditions	The game should start.
Main success scenario	<ul style="list-style-type: none"> ▪ The player should be able play the game.

Table 7: Use Case 7 of Find the Equipment

Use Case ID	UC-07
Use Case Name	Pause/Resume
Scope	Find the Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player must play the game.
Post-conditions	The game should pause or resume.
Main success scenario	<ul style="list-style-type: none"> ▪ Player must be able to pause the game if he gets interrupted and resume the game afterwards.

Table 8: Use Case 8 of Find the Equipment

Use Case ID	UC-08
Use Case Name	Find the Equipment
Scope	Find the Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player must play the game.
Post-conditions	Player should be able to enter a 3D environment.
Main success scenario	<ul style="list-style-type: none"> • The game should help the player to get a better recognition and understanding of the equipment.

Table 9: Use Case 9 of Find the Equipment

Use Case ID	UC-09
Use Case Name	Place in Correct spot
Scope	Find the Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player Must find the equipment
Post-conditions	10 seconds must be awarded to the player.
Main success scenario	<ul style="list-style-type: none"> • The game should help the player to get a better recognition and understanding of the equipment

Table 10: Use Case 10 of Find the Equipment

Use Case ID	UC-10
Use Case Name	Exit
Scope	Find the Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player must complete the game or exit manually.
Post-conditions	The game should end.
Main success scenario	<ul style="list-style-type: none">▪ The game should exit so that the player can play other games.

3.1.7.3: Use Case Diagram of Guess Equipment

Fig 3.1.7.3 describes the use case diagram of Guess Equipment of the game. The player acts as an actor in the diagram which is interacting with the system. The use cases in this system are "Start", "Pause/Resume", "Guess Equipment from environment", "Update Score" and "Exit". The 'extend' is for adding methods to the class but not to its instance. These use cases are further described in Table 11, Table 12, Table 13 and Table 14.

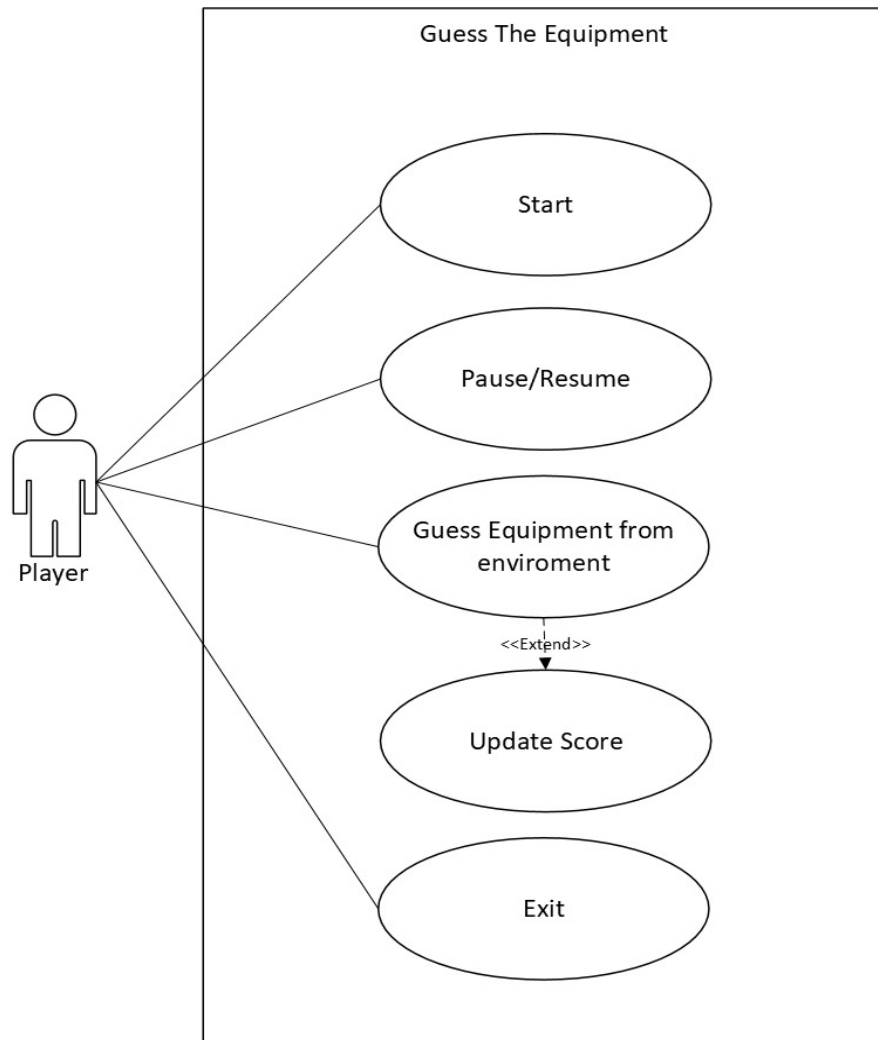


Figure 3.1.7.3: Use case Diagram Guess Equipment

Table 11: Use Case 11 of Guess Equipment

Use Case ID	UC-11
Use Case Name	Start
Scope	Guess Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player Should select this game from the "Select game" menu.
Post-conditions	The game should start.
Main success scenario	<ul style="list-style-type: none"> • The game should be able play the game.

Table 12: Use Case 12 of Guess Equipment

Use Case ID	UC-12
Use Case Name	Pause/Resume
Scope	Guess Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player must play the game.
Post-conditions	The game should pause or resume.
Main success scenario	<ul style="list-style-type: none"> • Player must be able to pause the game if he gets interrupted and resume the game afterwards.

Table 13: Use Case 13 of Guess Equipment

Use Case ID	UC-13
Use Case Name	Guess Equipment
Scope	Guess Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player must start the game.
Post-conditions	The equipment should come up for the player to guess.
Main success scenario	<ul style="list-style-type: none"> ▪ Player should be able to develop a better understanding of recognizing the equipment.

Table 14: Use Case 14 of Guess Equipment

Use Case ID	UC-14
Use Case Name	Exit
Scope	Guess Equipment
Level	User
Primary Actor	Player
Pre-conditions	Player must complete the game or exit manually.
Post-conditions	The game should end.
Main success scenario	<ul style="list-style-type: none"> ▪ The game should exit so that the player can play other games.

3.1.7.4: Use Case Diagram of Learning Portal

Fig 3.1.7.4 describes the use case diagram of Learning Portal of the game. The player acts as an actor in the diagram which is interacting with the system. The use cases in this system are "Select Device", "Equipment Model", "Equipment Uses", "Equipment Information" and "Equipment Working". These use cases are further described in Table 15, Table 16, Table 17, Table 18 and Table 19.

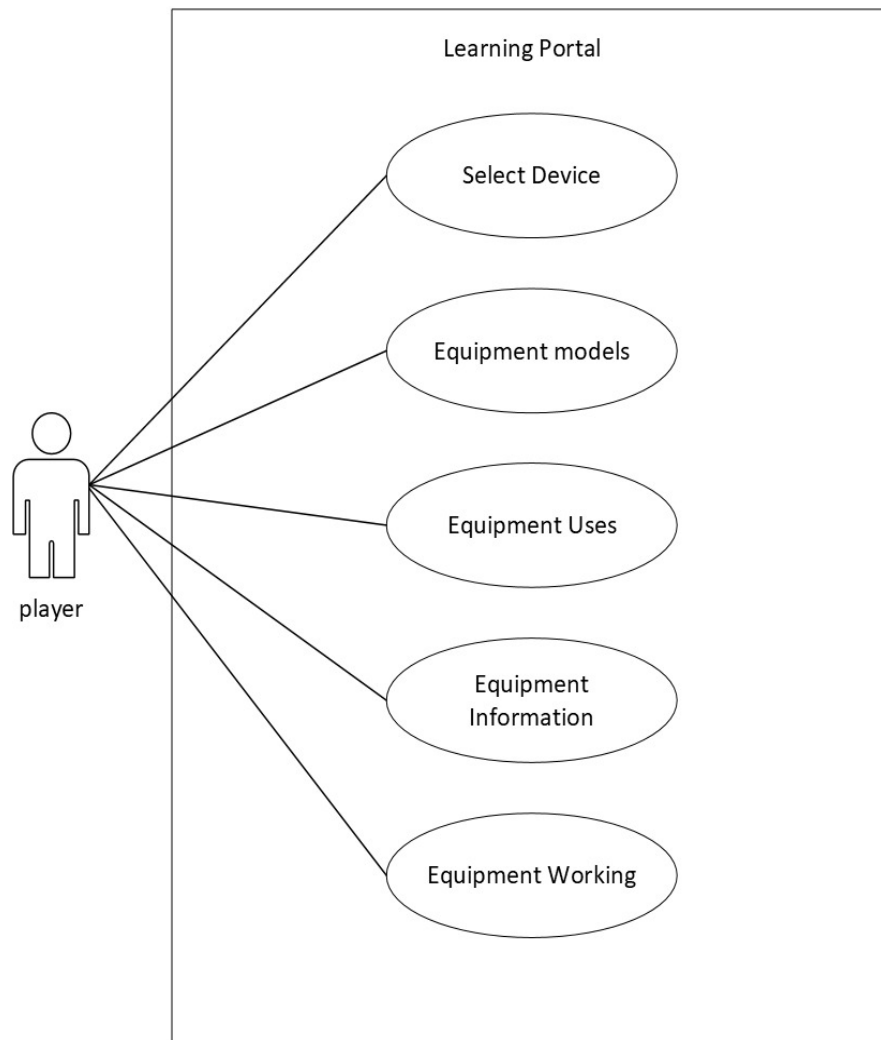


Figure 3.1.7.4: Use case Diagram of Find the Equipment

Table 15: Use Case 15 of Learning Portal

Use Case ID	UC-15
Use Case Name	Select Device
Scope	Learning Portal
Level	User
Primary Actor	Player
Pre-conditions	Player must select it from the menu.
Post-conditions	The equipment will get selected.
Main success scenario	<ul style="list-style-type: none"> To provide knowledge of different equipment to the player.

Table 16: Use Case 16 of Learning Portal

Use Case ID	UC-16
Use Case Name	Equipment model
Scope	Learning Portal
Level	User
Primary Actor	Player
Pre-conditions	Player must select the equipment.
Post-conditions	Game will display a 3D model of the equipment.
Main success scenario	<ul style="list-style-type: none"> To develop a better understanding of the design of the equipment.

Table 17: Use Case 17 of Learning Portal

Use Case ID	UC-17
Use Case Name	Equipment Uses
Scope	Learning Portal
Level	User
Primary Actor	Player
Pre-conditions	Player must select the equipment.
Post-conditions	Game will display the uses of the equipment.
Main success scenario	<ul style="list-style-type: none"> ▪ To develop a better understanding of the uses of the equipment.

Table 18: Use Case 18 of Learning Portal

Use Case ID	UC-18
Use Case Name	Equipment Information
Scope	Learning Portal
Level	User
Primary Actor	Player
Pre-conditions	Player must select the equipment.
Post-conditions	Game will display information of the equipment.
Main success scenario	<ul style="list-style-type: none"> ▪ To develop a better understanding of the information of the equipment.

Table 19: Use Case 19 of Learning Portal

Use Case ID	UC-19
Use Case Name	Equipment Working
Scope	Learning Portal
Level	User
Primary Actor	Player
Pre-conditions	Player must select the equipment.
Post-conditions	Game will display the working information of the equipment.
Main success scenario	<ul style="list-style-type: none">▪ To develop a better understanding of the working of the equipment.

Chapter 4: System Design

4 System Design

4.1 System Design

This section of the report entails some detail charts which will help to analyse the detailed structure of the Learning Aim. There will be different Unified Modeling Language diagrams which will help different aspects of the system. The UML diagrams that we used are as follow:

- Flowchart Diagram
- Architecture Diagram
- Sequence Diagram
- Activity Diagram
- Class Diagram
- ER Diagram
- Context Diagram
- GUI Design

4.1.1 Flow chart of Learning Aim

Flowchart tells us about the actual flow of the game. Figure 4.1.1 shows the Flow of "Learning Aim", where user will first see a splash screen and user will have 4 options:

- Select Modes**
 In select modes user will have option to play one of two modes i.e., "Find the Equipment" or "Guess the Equipment".
- Player profile**
 In player profile user can see his/her high score and can change/view their name.
- Learning Portal**
 In learning portal user can learn about different equipment by selecting an equipment. The information about the equipment will be displayed after selecting equipment.
- Quit**
 By selecting quit the game will shutdown gracefully.

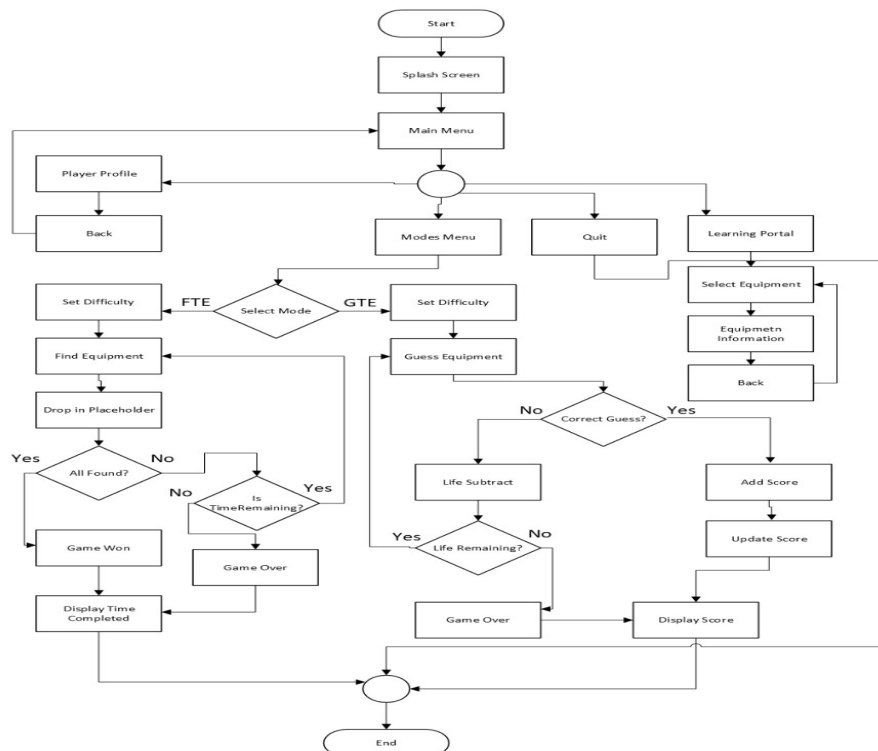


Figure 4.1.1: Flowchart of Learning Aim

4.1.2 Architectural Diagram

An architectural diagram is a diagram of a system that is used to abstract the overall outline of the software system and the relationships, constraints, and boundaries between components. The figure 4.1.2 elaborates the general architecture of the system. It shows the game's working, and relationship between player and the game.

The diagram includes GUI, graphics, user profile, props, environments and detail of games and learning portal.

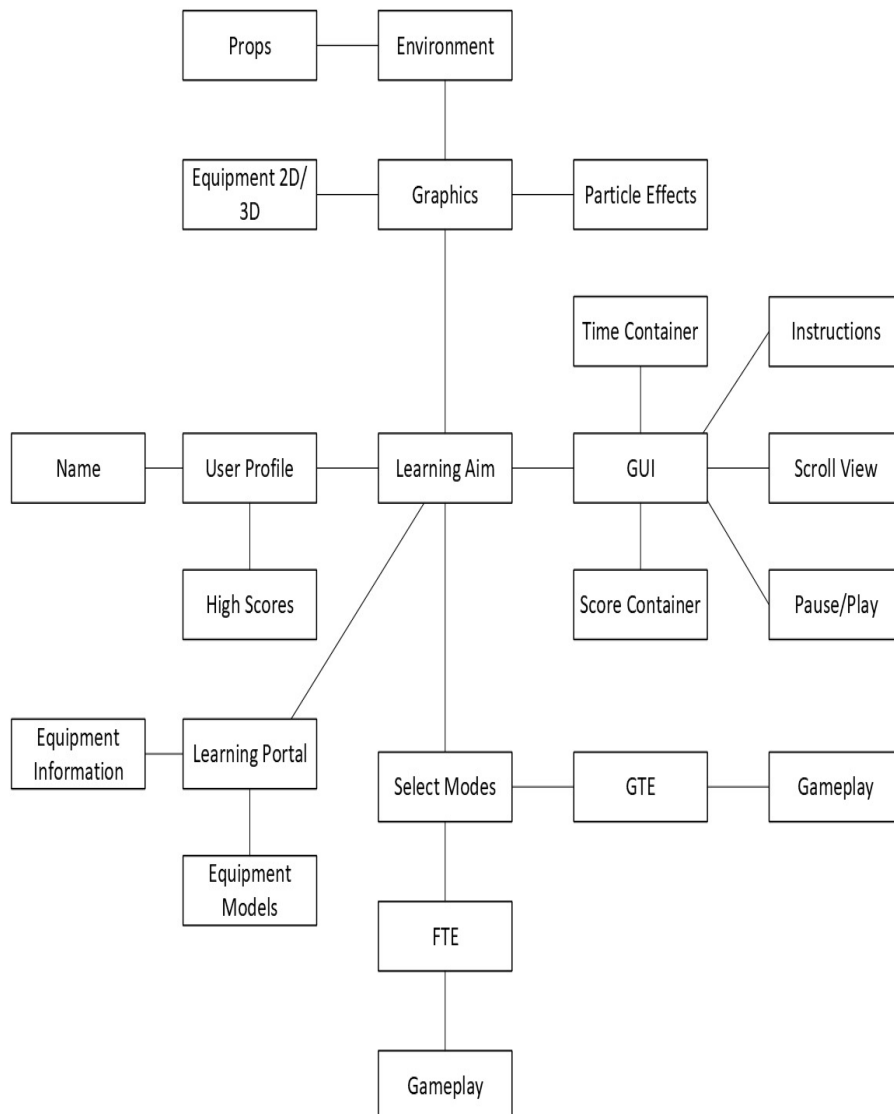


Figure 4.1.2: Architecture Diagram of the game

4.1.3 Sequence Diagram

A sequence diagram is a Unified Modeling Language (UML) diagram that illustrates the sequence of messages between objects in an interaction. A sequence diagram consists of a group of objects that are represented by lifelines, and the messages that they exchange over time during the interaction.

The figure 4.1.3 shows the sequence diagram of the game. The Player request for registration to the game and the game respond with the successful registration of the player. Similarly, the player request for learning portal and the game returns the learning portal to the player from the database. If the player request for Game Menu, the game menu will appear and when the player request for view profile, the will show the profile of the player after requesting it from the database where all the player profile is saved.

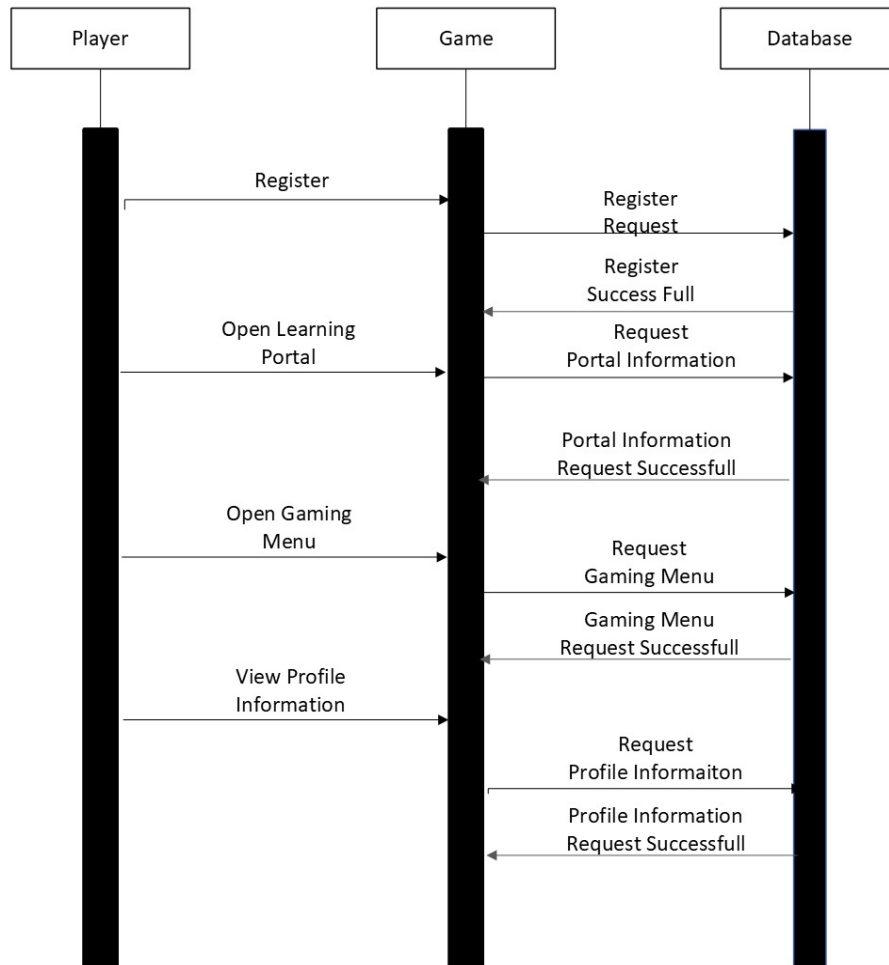


Figure 4.1.3: Sequence Diagram of the game

4.1.4 Activity Diagram

An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram.

4.1.4.1: Activity Diagram of Guess Equipment

Fig 4.1.4.1 describes that after starting the game named "Guess Equipment", it will check the answers. If the answer is correct, the score will be added and if the answer is wrong, the score will be subtracted. In the end, the score will be displayed.

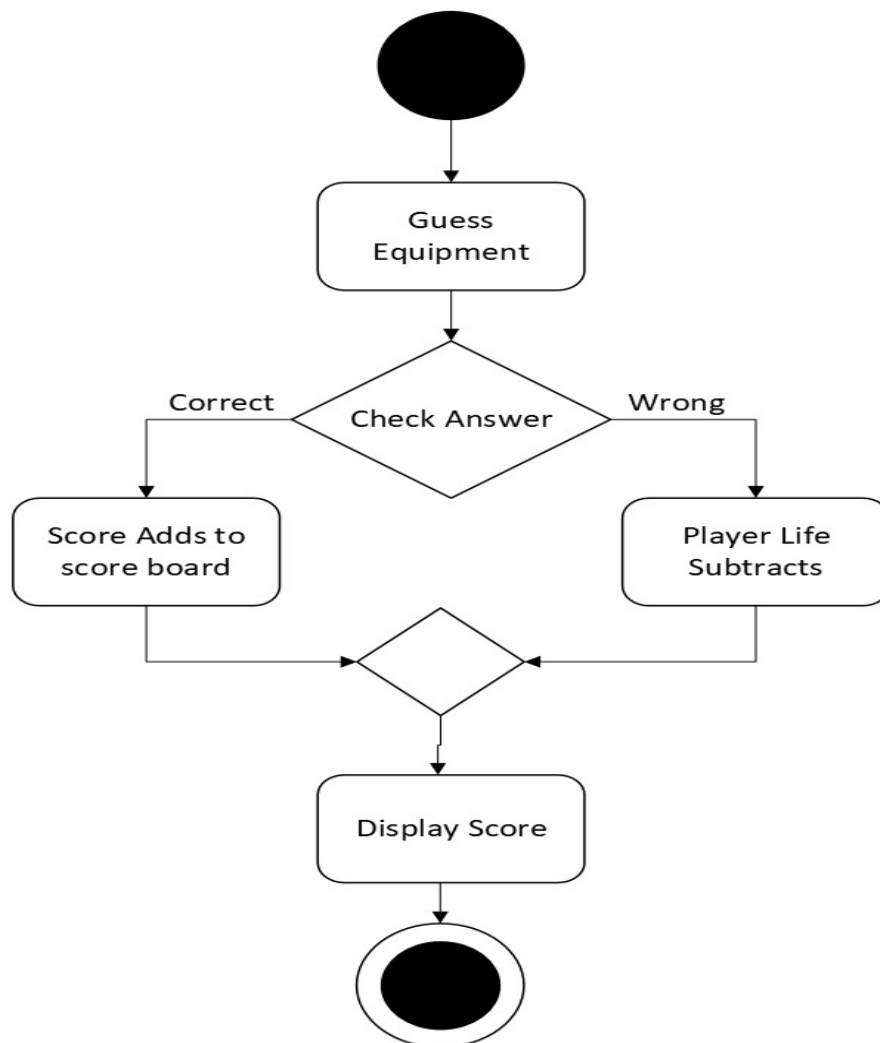


Figure 4.1.4.1: Activity diagram of Guess Equipment

4.1.4.2: Activity Diagram for Learning Portal

Fig 4.1.4.2 describes that after going to learning portal and selecting the option named "Select Equipment", the game will display the equipment 3D model, equipment uses, equipment information and equipment working.

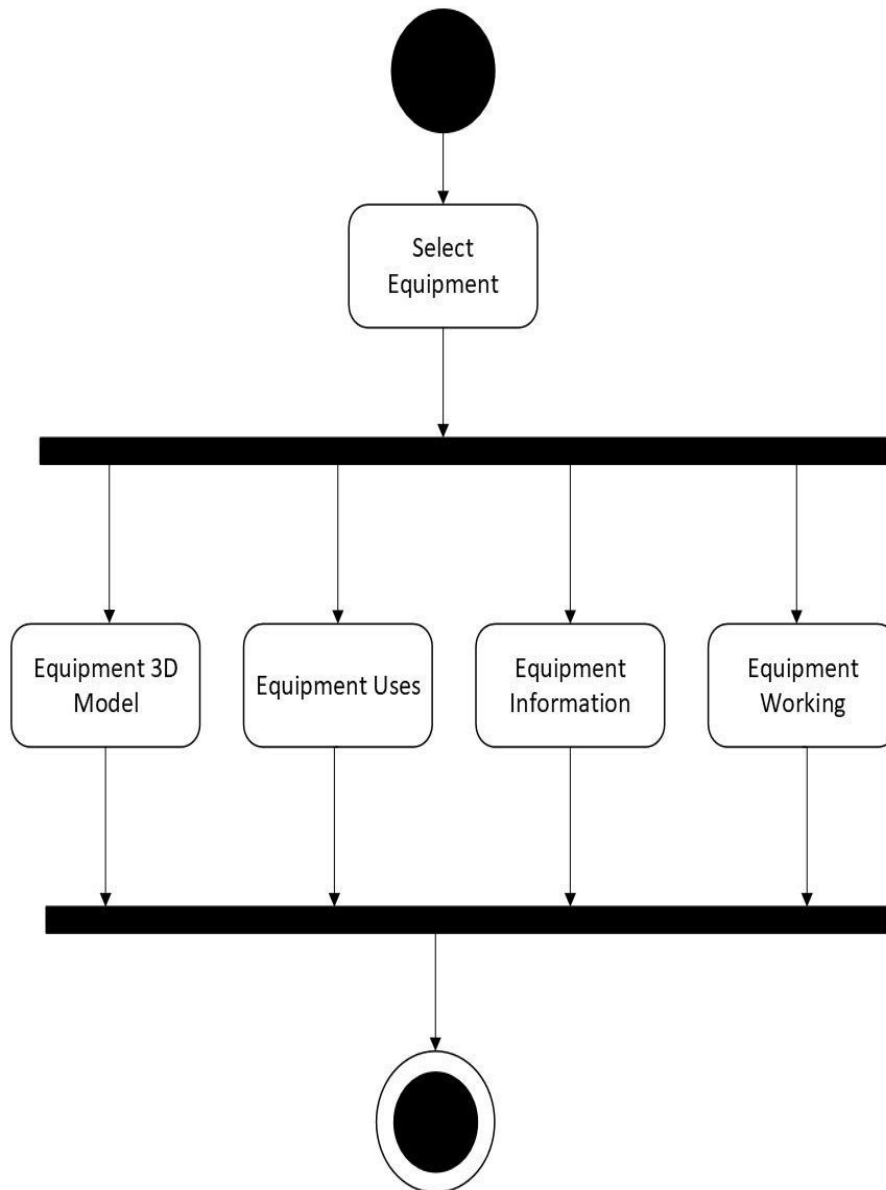


Figure 4.1.4.2: Activity diagram of Guess Equipment

4.1.4.3: Activity Diagram for Find the Equipment

Fig 4.1.4.3 describes that after starting the game named "Find the Equipment", the player has to find the hidden equipment. After finding the equipment, player has to place it in place holder. Game will check the equipment. If the equipment is correct, player will be awarded 10 extra seconds and if the equipment is wrong, player has to drop the equipment. In the end, the score of the player will be displayed.

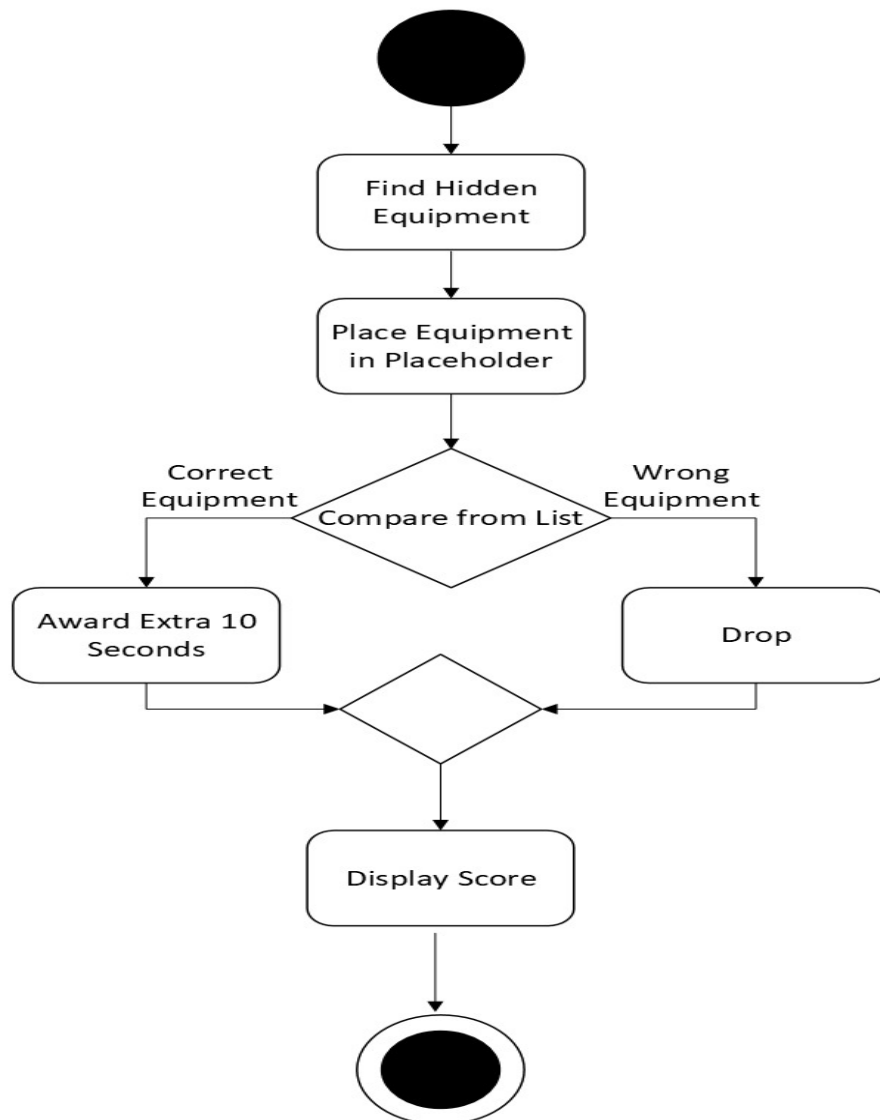


Figure 4.1.4.3: Activity diagram of Find the Equipment

4.1.4.3: Activity Diagram for Learning Aim

Fig 4.1.4.4 describes that after opening the game, player has to register himself. After registration, menu will be displayed to the player. The Menu consist of Games Menu which further has Select game option and Learning portal which further has Select Equipment option.

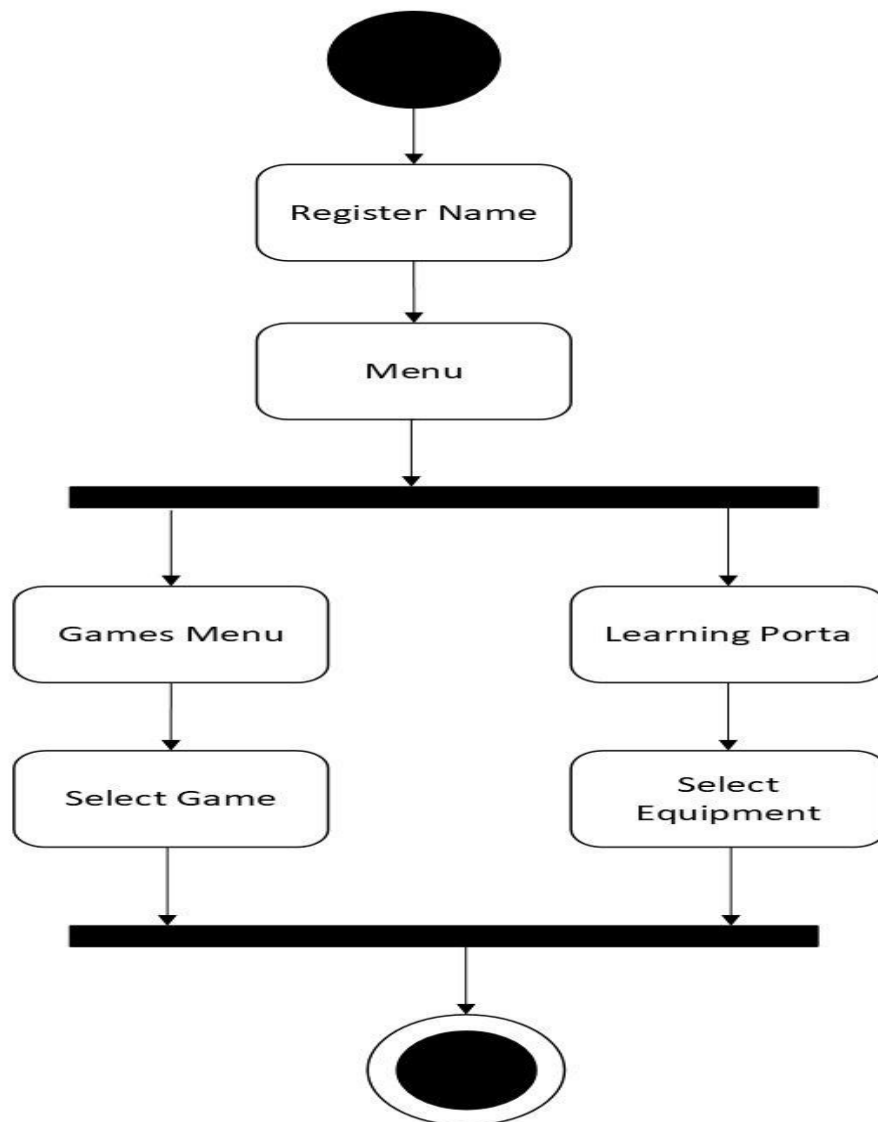


Figure 4.1.4.4: Activity diagram of Learning Aim

4.1.5 Class Diagram

A class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

Figure 4.1.5 shows class diagram of Learning Aim where 5 classes are included i.e. player, Find The Equipment, Guess Equipment, learning portal and games. Games is the center class where all classes interact or we can say that Games class interact will all classes.

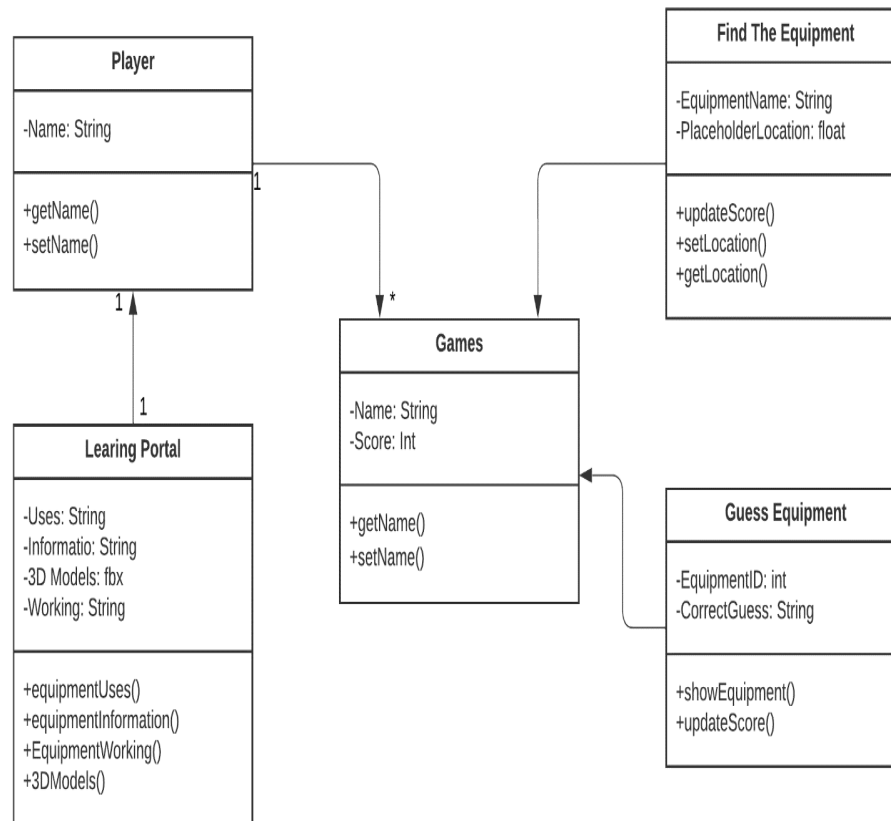


Figure 4.1.5: Class Diagram of the game

4.1.6 ER Diagram

An entity relationship diagram (ERD), also known as an entity relationship model, is a graphical representation that depicts relationships among people, objects, places, concepts or events within a system.

Figure 4.1.6 shows the ER Diagram of Learning Aim. Here we have 3 entities Player, Learning Portal and Games with different attributes. Player and Learning portal has a "learns" relation because player learns from learning portal and Games and Player has a "Plays" relation because player Plays the game. Player can view only one learning portal (one to one relation) whereas player can play multiple games(one to many relation).

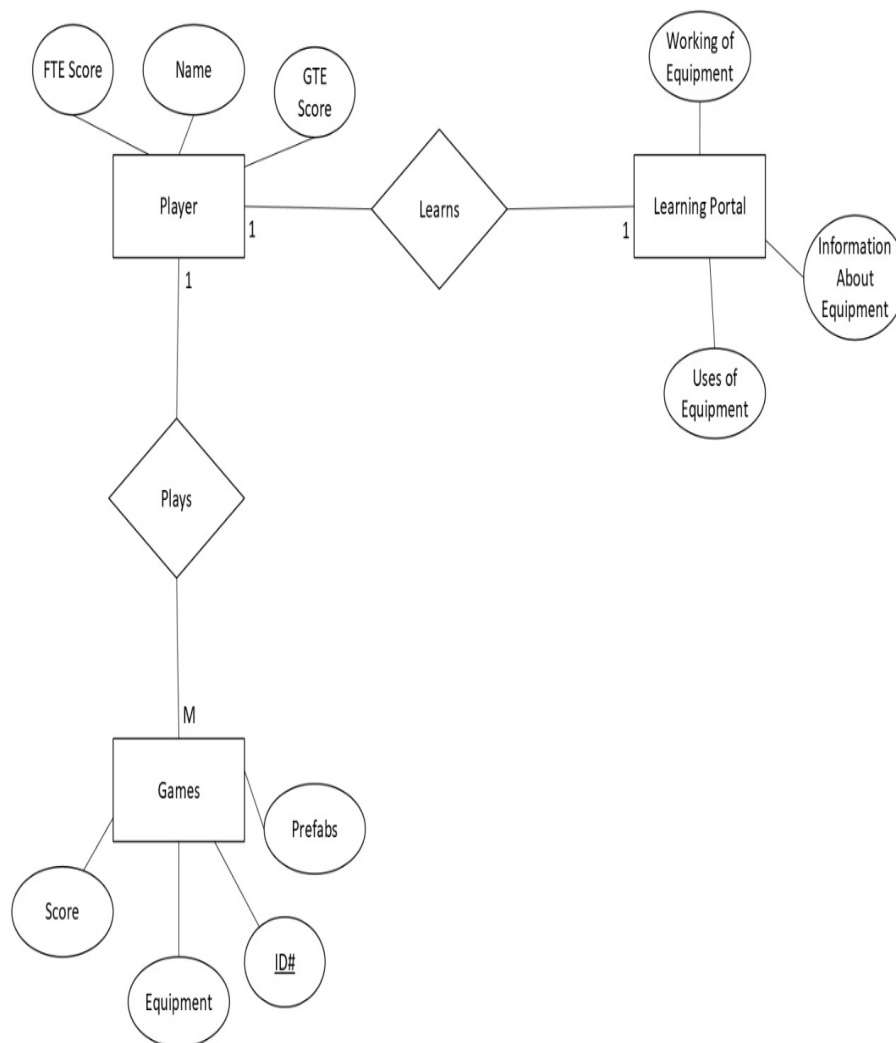


Figure 4.1.6: ER Diagram of the game

4.1.7 Context Diagram

The fig 4.1.7 explains the detail view of system architecture of our project. Player which is an external entity can easily access the game play mode by passing through single process. Moreover, player can select the level of difficulty according to his desire, view the instructions, go to learning portal and exit game when he need. All the processes which a player can done mentioned.

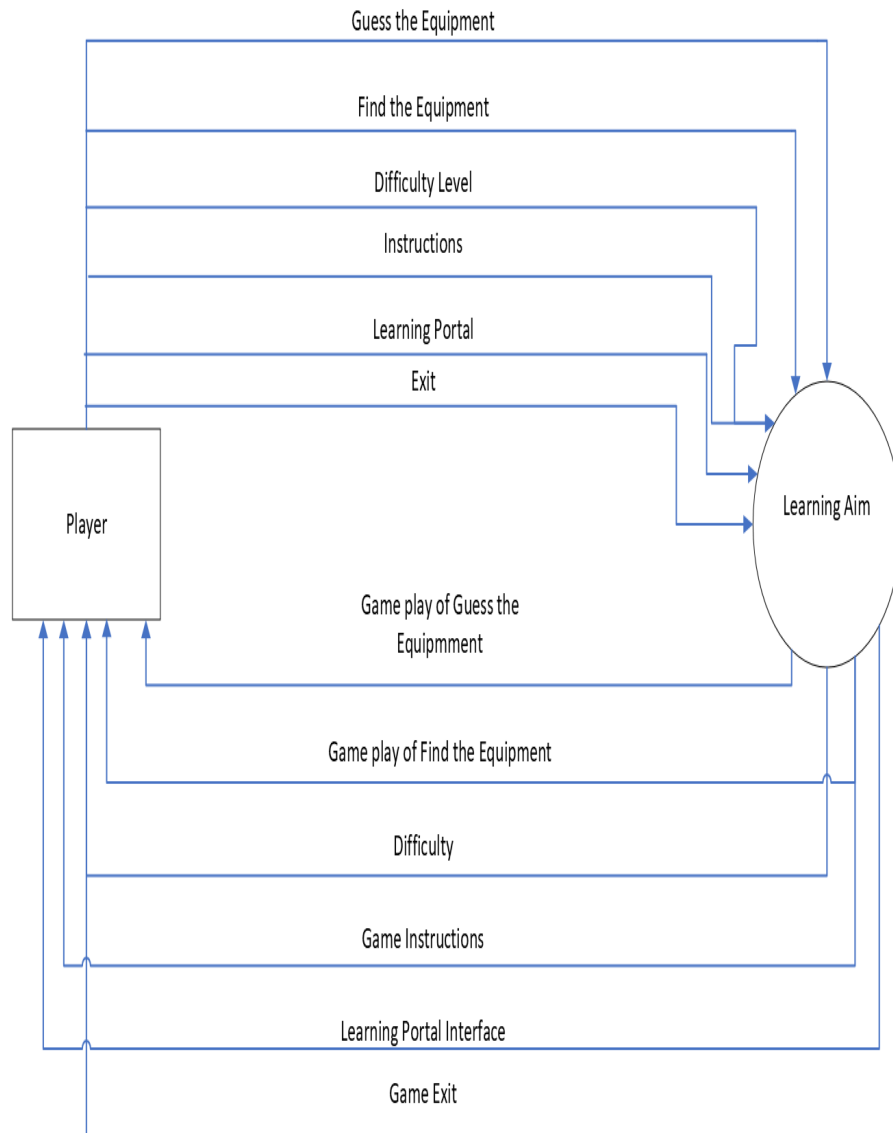


Figure 4.1.7: Context Diagram of the game

4.1.8 GUI Design

Fig 4.1.8 provides a rough outlook of how the main area of the application would look like when the application starts.



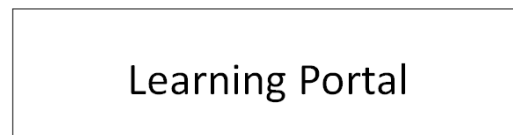
Enter Name

Submit

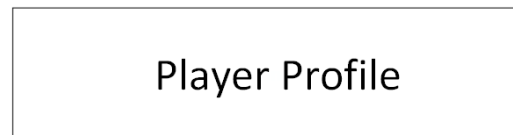
LEARNING AIM - IT'S A GAME



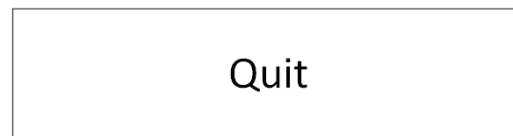
Select Modes



Learning Portal



Player Profile



Quit

Figure 4.1.8: GUI Design

Chapter 5: System Implementation

5 System Implementation

5.1 System summary

The Learning Aim game is a desktop-based application for Biomedical engineering students. It incorporates some of the best learning techniques through which gamer can learn about different equipment. The interface is user friendly and engaging so that gamer don't get bored. The game has numerous modes and the user can simply select any given mode of his desire. After selecting the mode, user can play the game and learn from it. The game runs smoothly and can be updated if needed. It included variety of equipment and its information. Moreover, if the gamer only wants to learn about the equipment, he can simply go to Learning portal.

Tools and Technology Used:

The tools and technology used in developing this project are listed below:

5.1.1 Environment

- Unity 3D
- Blender
- Adobe

5.2 Programming Language

- C#

5.2.1 Front-end design

- Unity 3D
- Blender
- Illustrator
- Photo shop
- Pro Grid

5.3 Processing Logic

The application's processing logic includes:

- Selecting the menu from the main screen.
 1. Selecting a Game:

- When the game is selected, the user enters in the game's interface and all the data is fetched from the database and loaded into the game.
- After game is loaded, gamer will play the game.
- Scores are added in the database and will be displayed to the user.

2. Selecting learning Portal

- When the gamer selects the learning portal, different equipment with its name will be displayed and user can click the equipment and get details of it.

3. Scoring Criteria

- **Scoring Criteria of Guess the Equipment:** The scoring criteria of the guess the equipment is that, when the correct equipment inside the bubble is popped, the score is added to the score board. The score of popping each bubble is 1. However, if the correct name is not selected or the bubble strike the spikes, a life is deducted from the user lives.
- **Scoring Criteria of Find the Equipment:** There is a certain time limit in Find the Equipment. All the equipment must be found in the specific time period. When the correct equipment is found and placed in the place holder, 10 more seconds are awarded. When the game is completed in given time period. The game in won otherwise you lose the game.

4. Item identification

- **Item identification of Guess the Equipment:** There is an equipment inside the bubble which user has to guess. After guessing the equipment, there is a list of names in scroll bar. When the correct name is selected, the bubble gets popped.
- **Item identification of Find the Equipment:** There is multiple equipment inside 3D environment. The "Tab" button must be pressed in order get the name of the equipment which is to find. After finding the correct equipment in the room, it must be placed in the placed holder. If it is correct equipment, the equipment will get placed easily.

4. Difficulty Mode:

- **Difficulty mode of Guess the Equipment:**Difficulty mode of Guess the Equipment consists of three modes i.e., Normal, Medium and Hard. In normal mod, the speed of the bubbles will be slow. Similarly, in medium mode, the speed of the bubbles will be moderate and in hard more, the speed of the bubbles will be fast.

- **Difficulty mode of Find the Equipment:**Difficulty mode of Find the Equipment consists of three modes i.e., Normal, Medium and Hard. In normal mode, the time given to the player to find the equipment will be longer. Similarly, in medium mode, the time to find the equipment will be moderate and in hard mode, the time to find the equipment will be shorter.

Chapter 6: System Testing and Evaluation

6 Chapter 6: System testing and evaluation

6.1 GUI testing

We designed a sophisticated and user interactive GUI (Graphical User Interface) which performs best on desktop system. We developed the game in such a way that it is concise and user engaging as much as possible so that the gamer doesn't get bored of playing it. We took a professional approach in designing the GUI with multiple different option where gamer can learn information of different equipment, play different modes of game and also playing the entire game in 3D environment. All the application's complex functionality is handled on the back-end and the GUI is kept as simple as possible so that the gamer doesn't get confused. The application is super easy to use for anyone.

6.2 Usability Testing

The application is made in such a way that it is completely user-friendly and fully engaging. Our main goal is to help the gamer learn about different equipment and in doing so, we made a simple yet graphically rich menu where user will be able to play different modes of game or he can tap on "Learning Portal" where he can have detailed information about the equipment. As the application's name implies "Learning Aim" so we have designed best approaches for the gamer to understand and learn about the equipment without even getting bored.

6.3 Functional Testing

All the features of learning aim are working as expected. The functions that are embedded to run the game are properly working and all the scoring criteria is also working fine. The functions are embedded in such a way that they are linked with other and perform best when needed.

6.4 Unit Testing

The project is composed of many assets. All the assets in our project are tested individually.

6.5 Reliability

As the application is designed for desktop system so with any difficulty, it will run smoothly on the PC but it is possible that the game will lag if the PC has a ram less the 2GB. The gamer can also encounter other issues regarding PC such as heating issue etc.

6.6 Compatibility Testing

All devices running Windows XP or higher can play Learning Aim. This covers almost 98.9 percent of all PC devices on the market today. Learning Aim will not work on any device that isn't running Windows XP or lower.

6.7 Exception Handling

Exceptions are thrown when unspecific input is provided for a specific set of output. The game can handle all the exceptions very smoothly.

6.8 Load Testing

The game will not have any load issue on the server side as it is single player game. However, there is a chance that system may get load because it is a 3D game and it requires system to work properly and efficiently.

6.9 Security Testing

As the game is offline so it does not face any security vulnerabilities regarding security testing.

6.10 Installation Testing

Learning Aim is easy to set up and use. When a user first uses the application after installation, they are welcomed by a splash screen with an animation in the center of the screen and with main menu options.

6.11 Test Case

A test case is a document, which has description, applicability, initial conditions and tasks. Use case testing is a technique that helps to identify test cases that cover the entire system, on a transaction by transaction basis, from start to finish. Table 20, table 21, table 22, table 23 and table 24 describes the test cases below.

Table 20: Test case 1 of Blender asset

Test Case #	01
Description	Testing the asset of blender
Applicable for	All the OS supporting Blender and Unity
Initial Condition	None
Task	After designing an asset in blender, it is imported in unity for testation and if the coding is working and animation is working correctly then it is done.

Table 21: Test case 2 for Guess the Equipment

Test Case #	02
Description	Test the Guess the Equipment
Applicable for	Running game
Initial Condition	Game must be played
Task	The game must show the equipment in the bubble and the bubble must pop when clicked on the right button. The score must add to the score board if clicked the right equipment else life is deducted. When it was all done then the testation was successful.

Table 22: Test case 3 for Find the Equipment

Test Case #	03
Description	Testing the Find the Equipment
Applicable for	Running game
Initial Condition	Game must be played
Task	The game must show the equipment in a 3D environment. Equipment must be able to get picked and placed on the right destination. Wrong equipment shouldn't be placed. The game must be completed in given time period. When it was all done then the testation was successful.

Table 23: Test case 4 for learning Portal

Test Case #	04
Description	Testing the learning portal
Applicable for	Running application
Initial Condition	Game must be opened
Task	Different equipment's name must be shown in a scroll bar. The equipment must be able to get selected and the show button must be working. After clicking on the show button, the information of the respected equipment must be shown. When it was all done then the testation was successful.

Table 24: Test case 5 for Player Profile

Test Case #	05
Description	Testing the player profile
Applicable for	Running application
Initial Condition	Game must be opened
Task	The high scores of the player regarding Guess the equipment and the best time of the player regarding find the equipment must be shown along with his name. When it was all done then the testation was successful.

Chapter 7: Conclusion

7 Conclusion

The project is mainly based on game which is not only entertaining and enjoyable but also helps you learn about biomedical engineering world. The interface of the game is completely user friendly and the gamer can easily select options according to his desire.

Not only the gamer can play game but he can also explore many equipment in the learning portal.

The purpose of this project is to provide the user with mind game which not only helps him to gain entertainment but also polish their analytical and identifying skills. The game will help the user to identify equipment and help him train in emergency situation. The game is developed in Unity software which has enabled us to make the game simple and user friendly.

Here we finalize our software description. Every aspect of our system is discussed in detail and successfully.

Project teaches us a lot about the experience of the practical work about how to manage the time, how to distribute the work load, how to work with a team and how to work in a professional life. We learned about how to design a project, how to implement the project, how to test the project and how to document the project. After the accomplishment of the project, we feel a lot encourage and enthusiasm. By completing this project, we concluded that nothing is impossible if you put the hard work and positive mind.

Appendix A

8 User Manual

The user manual will guide the user how to operate the application. It provides the overview of the complete system. The user guide of this application is given below.

8.1 Registering a player

Fig 8.1.0 shows the registration of the player.

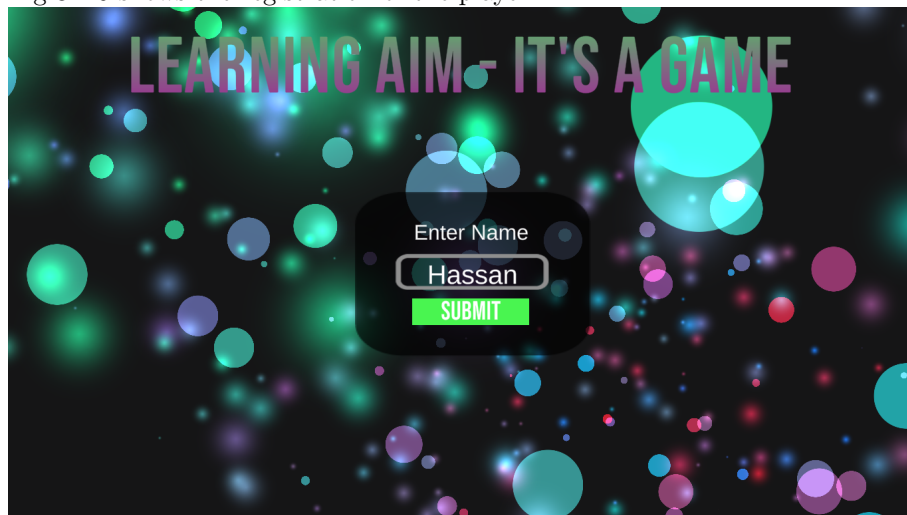


Figure 8.1.0: registering player

8.2 Main Menu

Fig 8.2.0 shows the main menu from which you can select different modes.



Figure 8.2.0: Main Menu

8.3 Select Modes

Fig 8.3.0 shows the game selection of Learning Aim.



Figure 8.3.0: Select Modes

8.4 Game Play of Guess the Equipment

Fig 8.4.0 shows the game play of Guess the Equipment.

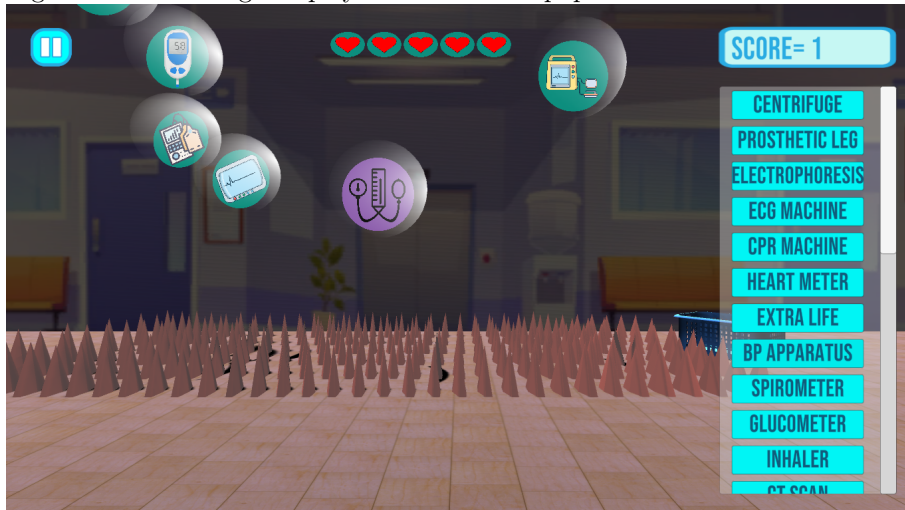


Figure 8.4.0: Game play of Guess The Equipment

8.5 Difficulty level of Guess the Equipment

Fig 8.5.0 shows the selection of difficulty in the game.

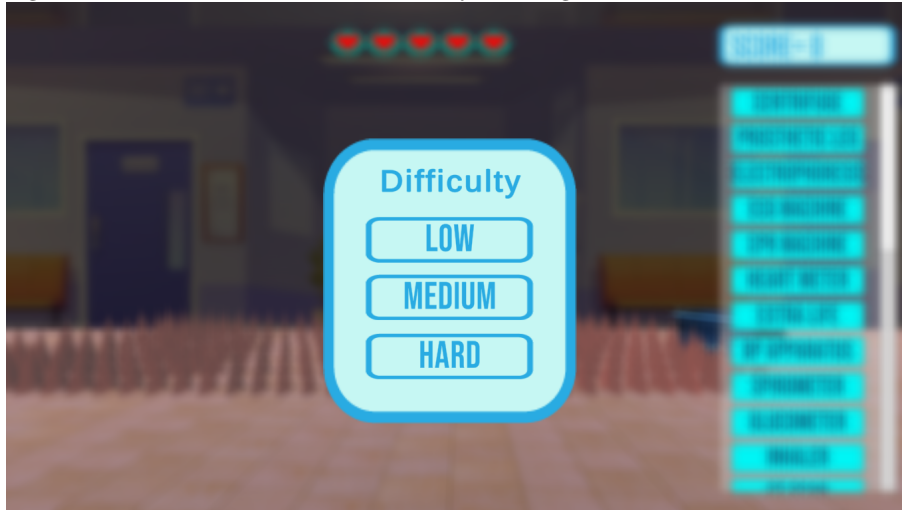


Figure 8.5.0: Difficulty levels of Guess the Equipment

8.6 Instructions of Guess The Equipment

Fig 8.6.0 shows the instructions of guess the equipment.

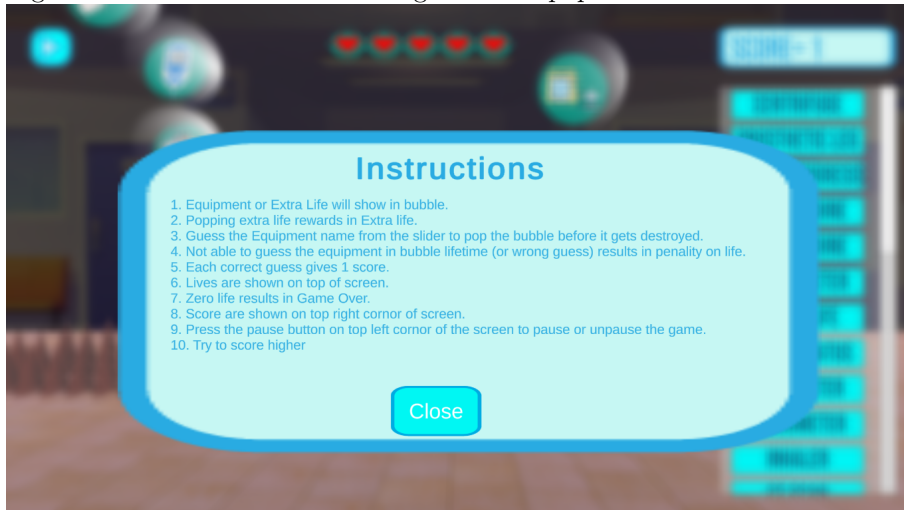


Figure 8.6.0: instructions of the Guess The Equipment.

8.7 Pausing Guess The Equipment

Fig 8.7.0 shows the pausing of guess the equipment.



Figure 8.7.0: Pausing the game

8.8 Game Over of Guess the Equipment

Fig 8.8.0 shows the game over screen of guess the equipment.

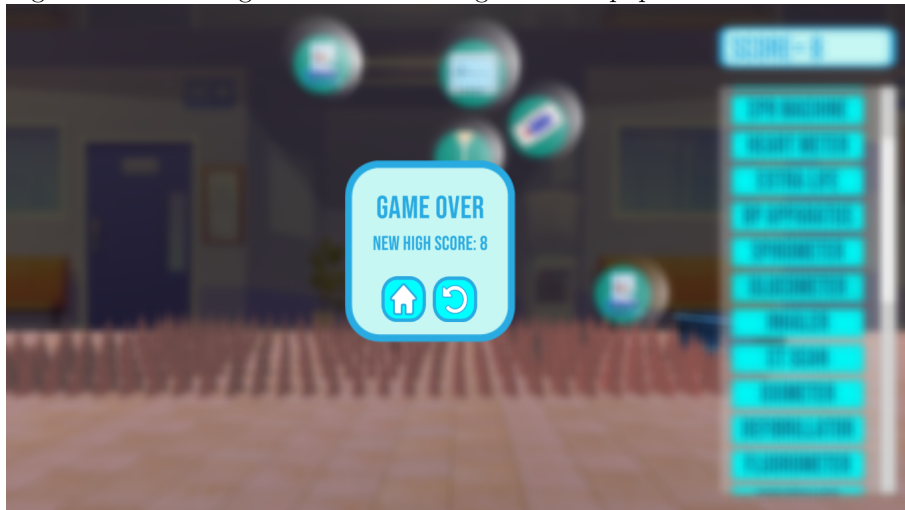


Figure 8.8.0: Game Over of Guess the Equipment

8.9 Game Play of Find The Equipment

Fig 8.9.0 shows the game play of Find the Equipment.



Figure 8.9.0: Game Play of Find The Equipment

8.10 Difficulty level of Find the Equipment

Fig 8.10.0 shows the difficulty level of find the equipment.



Figure 8.10.0: Difficulty level of Find the Equipment

8.11 Instructions of Find The Equipment

Fig 8.11.0 shows the instructions of Find the Equipment.

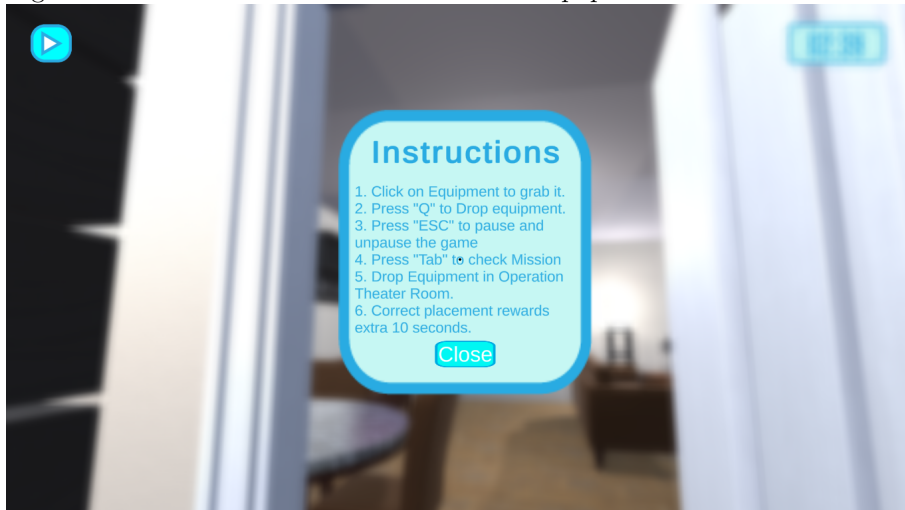


Figure 8.11.0: Instructions of Find The Equipment

8.12 Pausing Find The Equipment

Fig 8.12.0 shows the pause screen of Find the Equipment.



Figure 8.12.0: Pausing the game

8.13 Game Tasks

Fig 8.13.0 shows the tasks of Find the Equipment. Player can view tasks by pressing the "Tab" Button.



Figure 8.13.0: Game Tasks

8.14 Pick Equipment

Fig 8.14.0 shows the picking of the equipment.



Figure 8.14.0: Pick Equipment

8.15 Placing Equipment

Fig 8.15.0 shows where the equipment is to be placed after finding it. Player can place the equipment on the destination by pressing "Q" button.



Figure 8.15.0: Placing Equipment

8.16 Game Over

Fig 8.16.0 shows the game over screen of Find the Equipment.



Figure 8.16.0: Game Over

8.17 Learning Portal

Fig 8.17.0 shows the Learning portal screen of the game.

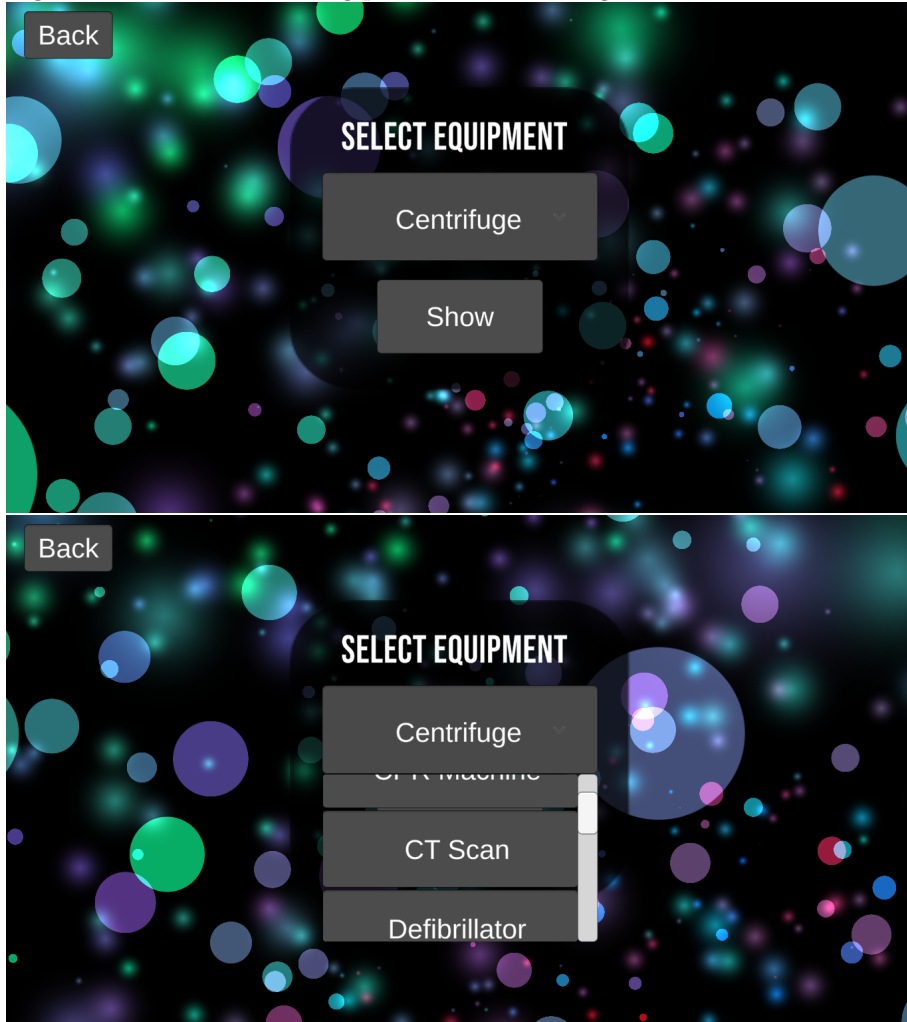


Figure 8.17.0: Learning Portal

8.18 Learning Portal Interface

Fig 8.18.0 shows information of selected equipment.

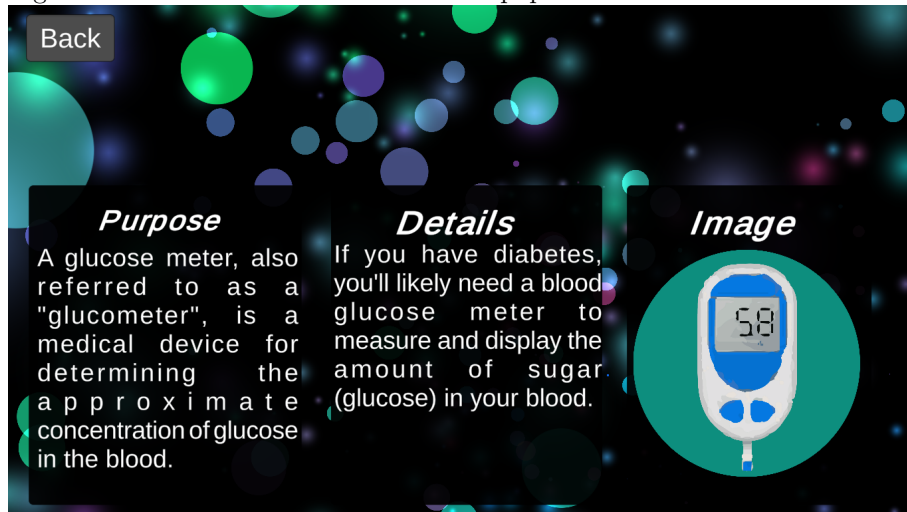


Figure 8.18.0: Learning Portal Interface

8.19 Player Profile

Fig 8.19.0 shows the player profile of the player.



Figure 8.19.0: Player Profile

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