Immortal AR Augmented Reality Game

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Abstract

Augmented reality (AR) is a technology which is picking up recently and aims in combining both real world and virtual objects. AR is also described as the Walkman of the 21st century, it has gained immense popularity in the field of games recently. AR not only finds its application in the field of games but even finds its application in various other fields such as the medical industry and film industry. As compared to all the games it is pretty evident by statistics that people prefer to play shooting games than probably games of any other genre. In order to carry this project, we are using a few AR associates like unity editor, android platform. This project revolves around the creation of a mobile AR shooting game covering all the physical movements and providing users a great gaming experience but ensuring players safety. The aim of the game is to create an illusion in the minds of players as though they are really in a battlefield with weapons to defend themselves and conquer the game. The objective is to eliminate all the enemy objects in the game and protect themselves from getting eliminated. This game brings the virtual objects into the real world through augmented reality to make gaming experience more immersive and enjoyable.

1. Introduction

Recently augmented reality is used in ecommerce industry with the ability to enhance and personalize the shopping experience of customers. AR is also used in social platforms to bring facial filters in application like snapchat, Facebook, Instagram and many more to bring cool features and to engage users in their application. AR is expected to grow 83 billion dollars by 2021 [10] which is a big market. In entertainment industry augmented reality is used to give players immersive experience and vide range of futures with variety of applications. AR is also used as a learning tool with the approach of mixed reality. It is used in application like tour guides in Museum by performing image targeting and recognition. AR is huge and rapidly growing market with vide variety of application using it.

In order to understand the correct definition and recognize AR from other types of realities this paper describes the augmented reality. Typically augmented reality is referred as the real world when mediated with virtual objects. The augmented reality is possible by bringing non real objects into real world through an application or a device. The non-real objects or augmented functionality consists of objects like 3D models, texts and pictures which are made according to need of applications. The relationship between different types of realities like VR, AR, MR are shown in [Fig. 1].The Hardware components used in augmented reality includes a processor, display, sensors (accelerometer, gyroscope, GPS) and input components. Now a days all the smart phones are capable to perform the augmented reality.The hand held display and head mounted display gives an opportunity to build AR gaming apps with more features. There are different types of AR games as shown in [Fig. 2].
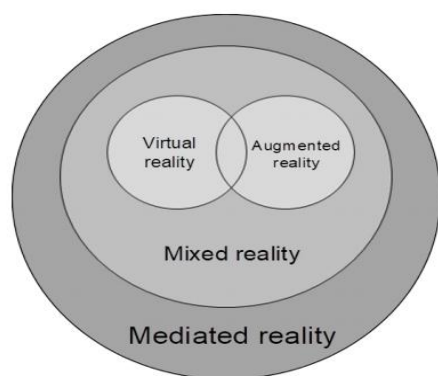
Figure 1: Realities and their relationships

The marker based mobile application uses a predefined target or marker to read and plays 3D models, images, texts or videos. The paper [4] gives example of Marker-Based AR application. The maker-less AR applications uses sensors to function. Sensors like Accelerometer, gyroscope and GPS are used to get required input data and display virtual objects accordingly. For example, the Pokémon go is a GPS tracked mobile augmented reality application. The [fig. 2[a, b, c,d]] clearly shows the different types augmented reality games which are present in current gaming industry.
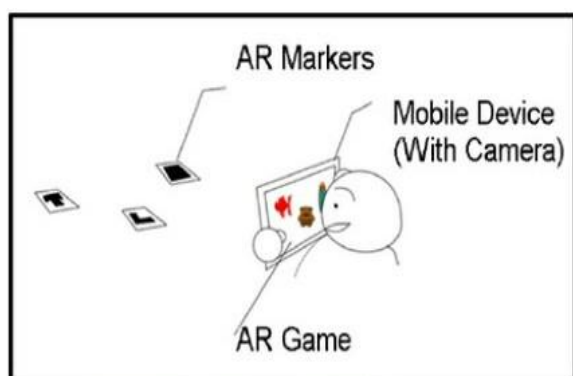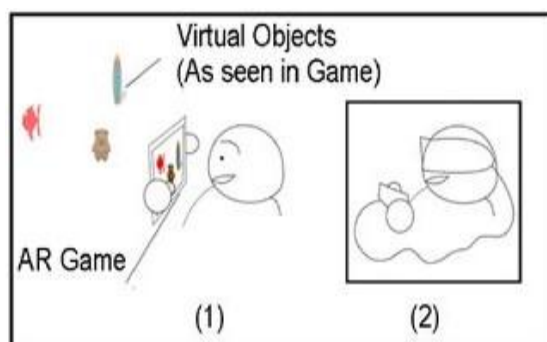

Figure 2[a]: Marker based AR Game.

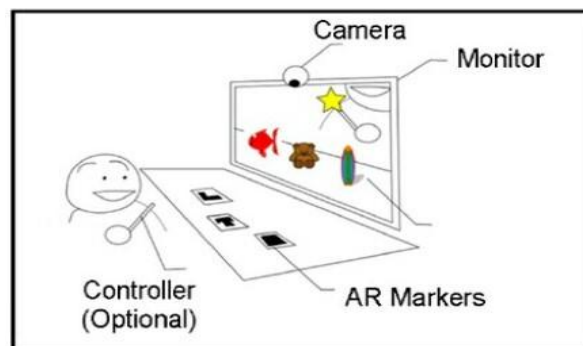Figure 2[b]: Accelerometer/Gyroscope based.

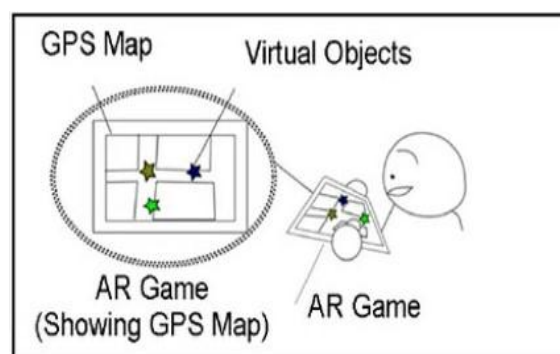Figure 2[c]: Spatial based AR Games.

Figure 2[d]: Location based AR Games.

The ImmortalAR game is based on the idea of a shooting game. The game uses augmented reality concept to bring more immersive experience to the player. The player needs to attack the AI objects that are coming towards them in real space in order to survive in the game. If the player maintains his stand against the enemy objects for a certain amount of time according to the level then they will win the match. The augmented reality concepts make this game more fun and enjoyable to play.

2. Literature Survey

Inverse Augmented Reality: A Virtual Agent's Perspective

Established a relationship between the virtual and physical world. There are various elements that developers need to lay emphasis on providing a better augmented reality game experience to the players. In this the authors [6] had discussed about the inverse augmented reality concept where both the physical and virtual objects coexist to form a relationship between them.

Pokemon Fight Augmented Reality Game

Explains the working approach of marker based augmented reality game. Here the author used unity 3d and Vuforia game engines to build this game in C#. The author [7] here proposed a game plan of fight between different Pokémon characters using marker-based approach.

Design of AR Game for enhancing interactivy and overcomming space limit.

From here got to know the fishing application that is built using the sensors and Vuforia together. Here the author [11] proposed that fishing in Augmented reality is possible by using head mounted camera and sensors and discussed more about enhancing interactivity between virtual objects and hand movements.

Implementation of Mobile Augmented Reality Based on Vuforia and Rawajali.

Here the authors [12] build AR application using image targeting. Described about how they build an application using unity 3d and Vuforia augmented reality game engine. This paper also explains the use of Rawajali for optimizing 3d models in the application. This paper [12] is proof of concept to build the application for an example of tour guide for future implementation.

3. Problem Statement

Existing game concept

Nowadays many AR games are marker based mobile applications. The SDKs like vuforia, ARToolKit and ARKit are mostly used to build application based on image targeting and render 3D models including audio and video over them. There is very less interaction with real world, and for the user interface they only use touch buttons on smart phones. Even though this types game has lot functions it lacks in providing immersive experience to the players using augmented reality

Proposed game concept

To keep players interactive, this paper proposes a real time AR game where users need not target a single image to play. The players shall have a mobile phone with Gyroscope sensor, rear camera and with the running game application. Firstly, the player's user interface shall consist of only touch screen input and real-world space. The game has several levels to change the user can choose any level. The game is to protect player by shooting the enemy drones and zombies that appear in the real-world space through augment reality. To improve the game environment the player can select different levels and proceed to play.

4. Design of the Application

Game flow

The player in the game plays against the AI objects, these objects are designed to create an immersive experience. During the game play when the player observes the enemy object approaching towards him/her the player defends himself by shooting them with the button provided in the user interface. When the game opens the user has a few options displayed on screen including start, select and exit are in the middle. with the option to play background music or not . You have the option of viewing the credits also at the bottom towards the right end of the screen [Fig. 3, 4].
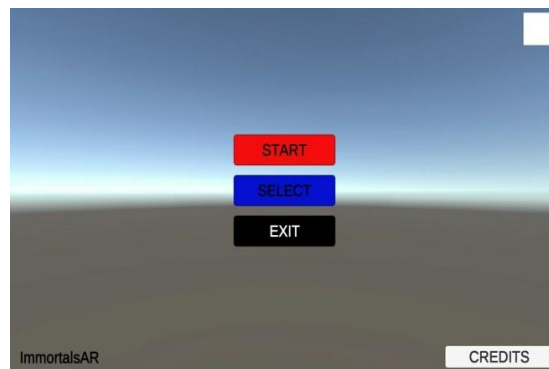

Figure 3: Menu screen with options.

The above figure shows the main screen of the game. It has option like start, select, exit on screen.

Figure 4: Option to view credits from main screen.

When the player selects the start button the game begins with quick instructions displayed and the player can start to point the phone in real space toward the enemy objects flying in real world, they need to shoot them in order to survive in the game [Fig. 5].
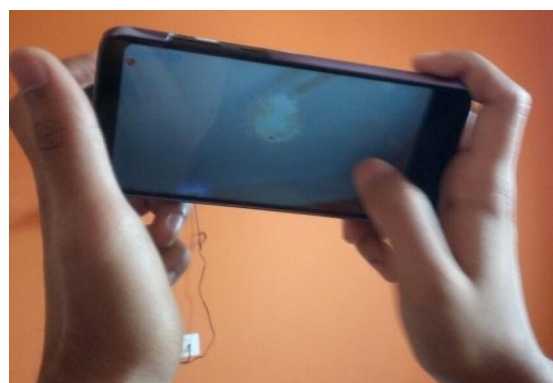

Figure 5: Image of enemy drone getting shoot.

In order to make this game more immersive in this app, It has a concept that will help players to regain health and survive in game for a long time by shooting at the blue colour capsules that are flying in real space. [Fig. 6]
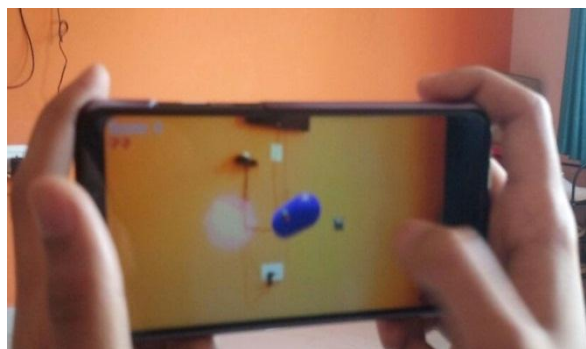
Figure 6: Shooting capsules in game.

The player wins only if all the enemy objects in that level are destroyed or else the player loses the match against the enemy objects.

5. Implementation

Requirments

This application is built using unity editor version 2018.4.19f1 for android version 6 and above. The functional, performance, design, operational requirements are the key factors that we concentrated on in order to build this application. Used C# as our first-choice programming language, visual studio to code. We performed augmented reality using an AR camera

Flow of system

This Game is made possible by following the methodology as in [Fig. 7]. The mobile device should have camera and additional sensors to detect the surroundings. This Game is built on base system and tracking library.
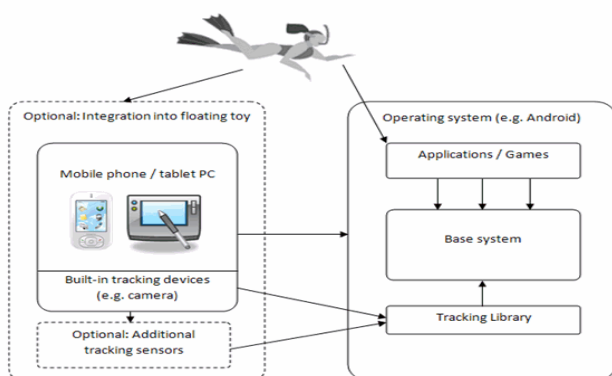

Figure 7: System flow chart.

Development environment.

This AR application is build using C# programming language in unity 3d. Visual studio 2017 is used for writing and editing code and used for debugging using its integrated debugger.
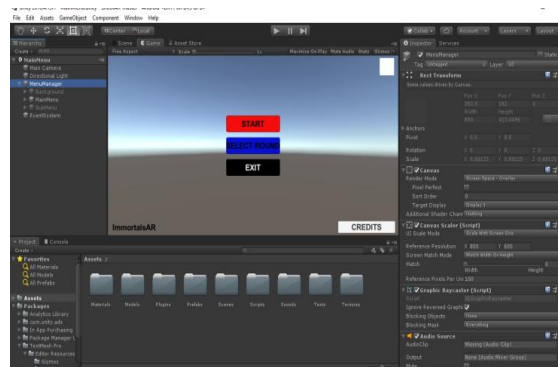

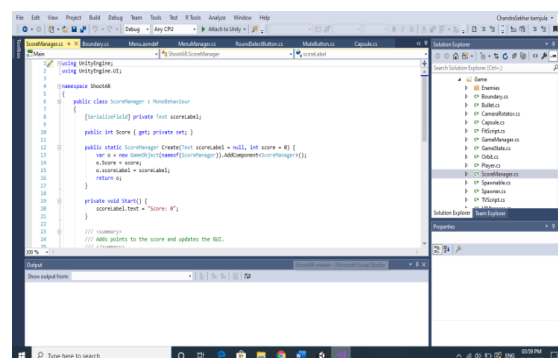Figure 8: Displaying unity 3d with assets and scenes.

Figure 9: Using visual studio to implement code.

The android SDK 23 and NDK r16b is used. The documentation provided by unity technologies is followed to build this application. Unity collaboration is used to develop this application in team.

6. Results and Analysis

Results of the application are shown in the game flow [Fig. 3, 4, 5, 6]. This ImmortalAR game is a sensor-based marker-less application. It supports the android version 6 and above. The comparison between this application and others based on image targeting, marker-based application is show below.

Points	ImmortalAR game	*Pokemon Fight Augmented Reality Game*	Dark: subject one	wallaMe	ARMY of R0bots	Zombie go
Type of AR game	Marker-less	Marker based	Marker less	Location based	Marker based	Marker-less
Bonus/extra	YES	NO	NO	NO	YES	NO
Leader boards	NO	YES	NO	NO	YES	NO
levels	YES	NO	YES	NO	YES	YES
Badges/awards	YES	NO	NO	YES	YES	NO
Achievements (missions, challenges)	YES	YES	YES	YES	YES	YES
Avatar	YES	YES	YES	NO	YES	NO
Virtual goods/services ownership	NO	NO	NO	YES	NO	NO

Figure 10: Comparison between ImmortalAR game and other AR based games.

Game Evaluation

This evaluation is aimed to analyse how the game impacted the impression and enjoyment factor of players. In order to evaluate we ran the game and conducted tests asking questions to different players. We asked a set of volunteers aged between 20 and 24 to play our game few of them had no prior experience in playing AR games.

On examining the game task completion time among varies participants, based on result we found that the participants who had experience in playing AR games completed task with good score. Further particularly participants with prior experience in playing AR games performed better. The participants who used additional game interaction capabilities like increasing player's health in game by shooting blue capsules were noticed with participants who had experience. The participants of no AR game experience noticed the difficulty in adopting the game and use it in full potential. Some participant not liked the AR experience saying their personal discomfort, dizziness and motion sickness. Mostly discomforts were widely cited as common effects of AR usage for first timers

Qualitative Analysis

According to participants, the interesting experience was to use this game in real world space. The game gave them the opportunity to play in the real world with use of augmented reality.
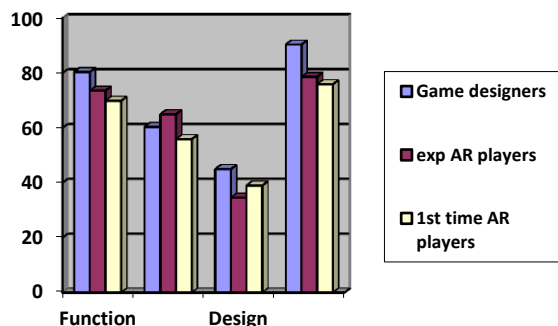

Figure 11: Rating level of game function, performance, design, and immersion.

The game function denotes the key components of the game like goals, rules, challenges and interactions. Based on what participants felt the game function indicates the deeper level of interaction in game and the game is challenging. Based on [Fig. 11] the level indicates the performance is average and so the design of the game is low because this game is built as a prototype and further changes to be done. Many participants in testing the game felt this game as very immersive.

Overall, the results are good and encouraging to purse the future work. Even though there were limitations and disadvantages, we believe that most of them are related to current implementation, which will be improved by updating the application. The features that can be added to this game are vast and every feature can have effects on enjoyment factor and immersion, which can provide varied and good gaming experience for users.

7. Conclusion and Future Work

This paper introduced the Immortal AR augmented reality game which is a shooting game. And also presented the typical game design and the implementation of the game with results. The analysis of the game shows that the game is enjoyable, immersive and gives a lot of future scope to improve the application.
For making Immortal AR game more enjoyable different interaction techniques would be explored. Techniques like implementing multi player version in game, and bringing more features like profile view for players and also, updating virtual objects in real space that makes this game even more immersive. This game will help us investigate more into current augmented reality world of building application for better environment in the field of games.

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