A Study on Gaming Engines Accessibility

Mayank Tyagi, Chetna Choudhary and Rana Majumdar

Abstract From the past few decades, video games had changed from a leisure time into a perspective of the evolution of new changes in human beings that is changing the way people think, behave, learn, and interact with other people all around the world. In compliment to this, games are also used in the sectors of education and health. Even after all the advancement in the recent gaming engines development, many people all around the world are still facing a lot of problem in the accessibility of the games due to their disability. These problems are: (1) Don't receive feedbacks; (2) No identification of in game responses; (3) No way to provide the input from the various input devices used. This paper surveys various gaming engines and their accessibility with the advancement in technology of the gaming engines being used. Majority of games are surveyed for different types of problems faced by people and how the gaming engines have evolved during the last few decades to match the emotions and intensity felt by people playing their respective games with full involvement.

Keywords Evolution · Disability · Identification · Gaming · Engines

1 Introduction

Over the past few decades, games have become a part of many individuals across this whole world. The worldwide sales of various games over the whole globe are even surpassing the sales of Hollywood movies; such is the craze for playing video games. This whole concept of this huge popularity can be explained by the fact that the movies, books, and music cannot provide interaction with the real-time user.

M. Tyagi (✉) · C. Choudhary · R. Majumdar
Amity University, Noida, Uttar Pradesh, India
e-mail: mayank18tyagi@gmail.com

C. Choudhary
e-mail: cchoudhary@amity.edu

R. Majumdar
e-mail: rmajumdar@amity.edu

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Software technology is difficult to provide access for players who are suffering from different types of disabilities. In the previous years, a lot of efforts have been taken to improve the state of accessibility of software to the disabled people. Due to this, various operating systems have accessibility features inbuilt, such as screen readers and support for keyboard shortcuts. During the 1990s, introduction of new technologies helps everyone to access World Wide Web such as Internet and use of email, which led to the definition of the W3C Web Content Accessibility Guidelines (WCAG).

Games are different from software, as their main use is for entertainment. The whole purpose is for entertaining the people playing games in their leisure time. There were two efforts made for the set of game accessibility guidelines similar to the W3C web content guidelines [1]. The Independent Game Developers Association (IGDA) Special Interest Group (SIG) on Game Accessibility published in a white paper [2] in 2004 that uses the 19 accessibility guidelines derived from a survey from 20 accessible games. Most of these games do include games for the visual disability and support motor and hearing impaired. Guidelines are that they assume an absolute validity, but in are only applicable in specific contexts [3, 4, 5]. For example, "provide subtitles" [2] is not applicable to a game without audio dialogs. "Allow for variable game speed" [6] is not appropriate for the games which are based on turns such as chess. One more problem with the guidelines was that they did not explain what type of disability to work on and because of all these problems the game developers face the problems of what type of guidelines they should follow to make a game more accessible for the users all around the world. The gaming guidelines which still exist were made way back in 2004 for a small number of genres and video games. Since then various gaming engines have been developed over the span of 13 years with more complex models and less genres being included in their guidelines.

This paper provides a detailed theory on how the people are using the games as a platform to express themselves, the research sectors and practicing the accessibility of these games. The goals of this surveys are as follows: (1) To check how a person is able to play a game is affected by his disability; (2) To make models and advanced techniques to make the games more accessible for the people; and (3) to identify various sectors for the future research work. The remainder of this paper identifies the techniques and the discussion over various accessibility issues faced by people.

The paper also explains to us about few gaming engines and how the real-life experience while playing those games have changed the perception of different societies. This survey will also show us about the latest gaming engines which are helping the game developers to put more real-life experiences into the game and provide more in-depth analysis of different types of languages used in developing these types of gaming engines.

Serious games and their applications in industry, organizations and other "genuine" territories is a quickly developing inclination. An accomplishment of genuine amusement or genuine gamified application's usage and use in industry altogether relies upon nature of outer specialized gamification stage to be utilized, or, genuine amusement motor (SGE). The objectives of the current SGE Research Group venture at Bradley University (Peoria, IL) incorporate an investigation of 100 + genuine

diversions and genuine gamified applications in industry, improvement of an extensive SGE Near Analysis Framework, and order of SGE and positioning of nature of SGE highlights, and age of an arrangement of suggestions on choice and use of SGE. This paper presents the primary discoveries and results of the SGE inquire about venture [7].

2 Natures of Disabilities

Before introducing various gaming models, this section provides background information on disabilities and video games, as well as a consistent reference. Video games are of different genres and more than 20 genres had been identified [6, 8–10]. In reference to the players with impairments or disabilities, the survey is using the classification of impairments as defined by the World Health Organization's (WHO) manual: International Classification of Impairments, Disabilities and Handicaps (ICIDH). This classification is in accordance with the writing guidelines for technology and people with disabilities:

(1) **Visual Disability**—It is because of a specific degree of vision loss with respect to low vision and partial sightedness, legal, and complete blindness. Color blindness comes under visual impairment or disability.
(2) **Hearing Disability**—It refers to the partial or complete loss of hearing ability. The impairment level can be from mild to chronic. Deafness is the term which refers to the completely losing of hearing ability from both the ears.
(3) **Motor Disability**—It is the limiting the muscle movement or complete loss in mobility of a functional muscle of a body. The common issues include paralysis, arthritis, and repetition of a strain injury. This type of impairment may also include hindrances in speech control and the urgency to use input devices other than a mouse or a keyboard.
(4) **Cognitive Disability**—causes a slight but noticeable and measurable **decline** in **cognitive** abilities, including memory and thinking skills. A person with MCI is at an increased risk of developing Alzheimer's or another dementia.

3 Interactive Gaming Models

Due to various types of impairments and disabilities, a person is not able to play games. To improve this situation, a different type of generic gaming model is made based upon what type of disability a person is bearing. These models were based on how a person interacts with various types of gaming genres, play, and provide input for its respective actions and then finding similarities between the next steps that will be performed when playing any type of a game. An example of this analysis and in order to illustrate how the model was derived, the next portion shows the interaction

of a player with three different game types of games (First-person shooter, puzzles and racing games) divided into different number of steps. The gaming interaction model consists of the following three steps:

3.1 Receiving the Stimuli

Games do provide a stimulus in the following forms: Haptic, visual and auditory. It depends on the types of games; stimuli can also be divided into furthermore two categories:

(a) Stimuli (Primary)—It must be perceived by the player to play any game. All games follow stimuli to play various games by using visuals. For example, in a first-person shooter (FPS) game, visuals are used as an primary stimuli and without providing any feedback which is based on visuals the games cannot be played. Even though sound and haptic feedbacks are being provided but this doesn't guarantee that the game can be played properly with any hindrances. Taking an example is that a person may be able to identify his enemy's presence and hear them too but they won't be able to identify where his enemy is located. The problem of this location identification makes it very tough for the person suffering from the visual disability. Thus, many games such as which are based upon dance and music they heavily rely upon music to such an extent that both the audio and visuals are primary stimuli.
(b) Stimuli (Secondary)—It is defined as an additional supplement to the stimulus which are primary. Although the ability to play a game doesn't depend upon the secondary stimuli. In a first-person shooting game, a person can still play a game without having the audio and haptic feedbacks whereas they might suffer from a decreased gaming experience which will reduce the user review about that particular game, but the person can still play that game to a very large extent without interrupting the gameplay.

3.2 Response Time Determination

Based on responses and stimuli, the player must give or choose which in game responses he should use from the available playing actions and these actions are specifically present in the game and are well defined by the game genre. For an example, an RTS type of game engine will only allow the player to regroup its units whereas an FPS type of game will allow the player to navigate his or her character which is defined by the game genre.

3.3 Providing Inputs

The player must use the input action physically while playing a game in response to a specific action which is based on various responses already present in the game. Generally, games do require a physical device to map the actions provided by the game from keyboards, mouse, joysticks, controllers, and other input devices. Many games also use voice recognition to play games.

Input devices are differentiated into two different types:

- **Discrete inputs**

It is a device which measures inputs which are discrete and has an on-off switch function. Examples are keyboards and buttons of a controller.

- **Analog inputs**

It is a device that calculates the input which is continuous for example inputs coming from a mouse or a controller. It is all because the intensity of interaction needed for controlling an analog input device is much higher than that of a discrete device, more precise motor skills are a must. If the input is small, then the discrete inputs are easy to handle and control in games. In various cases when the number of outputs is very high that is when a multi-key game is played on a keyboard to perform various actions in the game, then it becomes very difficult for a gamer or a person to play a game more efficiently. For improving such problems, we use controllers which have a combination of both analog and discrete inputs which are being used by the gamer. Most of the controllers are having two analog sticks used as inputs and various numbers of discrete buttons or triggers as an input. These input controllers can also come in the form of wheel controllers more specifically used in playing racing games thus also provide a real-life experience for the gamers or the person playing that specific game. These controllers thus provide the user to play a game more efficiently.

4 Gaming Engines of Varying Types

Unreal Engine—It is one of the older games in terms of development; this engine is best suited for FPS like (the Unreal tournament). Well like many other gaming engines, this unreal engine not only provides tools for game building but also provide the C ++ source code. With the passage of time and years, the developers all across the globe have put this engine to a more innovative use and are using it to make more complex games for the gamers. This engine operates based on subscription, if we talk about the game development world; Double-edged is the term which defines the functioning of Unreal gaming engine.

Unity Engine—This engine was first introduced more than a decade ago as a game development platform for Apple' operating system X, the Unity game engine

Table 1 Tabular formation

First-person shooter (Counter Strike)	Puzzle games (Candy block mania)	Racing games (Split Second)	Player
Enemy is visible. Explosions can be heard	Music is available and a block is falling	The road and car's opponent is available. Music is available with feedbacks	The player receives the stimuli
Player can decide to fire	The player decides to change the shape of the block and the way it falls	An opponent is overtaken by speeding up the car and using additional nitro	The player determines the response
The gun is fired once the player presses his button on the controller	With the help of arrow keys player changes the path of the block before dropping it down using space bar	The player uses the wheel to tilt it against other opponents	Input is provided
The enemy has been killed and a new enemy will be reborn	When the whole line is cleared then a new block will appear	The opponent is overtaken and the racer can lead	All the steps from 1, 2, 3 are repeated

now supports and give platform to a variety of gaming engines which works in Xbox, PlayStation, Windows and mobile OS such as iOS and Android. The Developers use Boo (similar to python) and C# to develop the Unity engine. Like the Unreal engine, Unity is offered on the basis of a subscription (Table 1).

Cry Engine—Talking about the above discussion, in the comparison of Lumberyard by Amazon, this engine is favored more by the developers the rendering qualities provided by this engine. It is also based on the basis of subscription, and then it also provides full licensing by adding support from its platform creator known as Crytek along with the access to the source code. The Crytek is not free and it also sells its software with some cost and moreover unlike its other competitors it doesn't demand a number of developer royalties being offered. Majority of the games under this engine includes the Everybody Gone to Rapture and Homefront.

Corona SDK—It is a platform which features a large library made up of API and also provides various tools for the development which supports a lot of platforms such as Android, iOS, and further Windows phone also. The Corona SDK is mainly based on OpenGL 2.0. This version is not on free subscription basis in fact it is having a high cost depending upon the range of $78 or $198 a month per seat.

5 Problem Conceptualisation and Strategies Identified

There is a very small amount of games that need to fix the needs of individuals with different types of disabilities and after the important work done there are few strategies which are being provided on the basis of similarities between all these games. These strategies include various factors as below

- **Reducing time factors**—These games are hardly depending on time and thus are way too time sensitive and as a result, there is no external or extra pressure on the player for making a decision to respond within a specific frame of time period. There are games that stops so frequently that the overall user experience is so bad the user end up neglecting the game completely at times.
- **Reduce the features of various stimuli**—The games which consist of various coinciding features do provide with some amount of visual features too. All the game objects are limited on the screen and whatever the information is required by the gamer to play a certain type of game is available on the main screen without any interruption.
- **Reducing the inputs**—This technique is very much similar to the techniques in which the games are used for making more games more accessible for the impaired people who are mostly impaired. If we talk about almost every game that is cognitive then these games give very less or limited controls that are intuition based for impaired people by using various actions such as touch screen controls. Hence thereby reducing the various inputs we can achieve our desired automatic input through these strategies.

6 Conclusions

A very large number of games that are accessible were surveyed for different types of problems related to disabilities and impairments and thus many strategies were discussed for the development phase. Very limited types of genres of games are discussed in this survey. After applying various accessibility techniques, the changes were observed in terms of gameplay alteration and one thing that the developers need to understand about the games that they need to make games which are more relevant and are fun to play because in the end if the game is not fun to play then how can a developer expect the game to be launched successfully in the market among different sets of people with disabilities and no disabilities. This study also pointed out how the future work can be carried out in the research sector. Many popular games are based on strategies and first-person role-playing games do lack a lot of accessible options for many disabled people thus very few games have been developed for the cognitive players who are suffering from various impairments. Thus, the developers should be investing their time in carrying out strategies to make the games more accessible for the disabled people so as to increase their game sales. The development sector can

improvise on these strategies and bank on them for future purposes of helping the disabled in playing the games.

7 Future Scope

Various genres in games—As previously discussed in the above portions, we got to know that many disabled people can only play games in very limited ways and a very specific type of games are playable. Many new popular games which are made by using various gaming engines such as Unreal, Unity, Cry Engine and corona SDK which do make games in the categories of sports, strategies and first-person role-playing games genres are still not available for these disabled people. While for those people who are disabled by hearing, they are still able to play games more efficiently in comparison to several motor and visually disabled people who are not able to play these games at all. But still in the case of first-person shooter games, these games are made accessible for all the types of disabilities and impairment [11–13]. First-person shooter games are different from rest of the games because they are based on open sources and these games also allow to make modifications to the respective games by using various software development tools and kits [14] By reusing an already existing game also reduce the costs of further developing an already accessible game.

Cognitive disabilities—These disabilities are very variable and change a lot and thus are very complex to understand. The hindrances faced during the research work. The hindrances mainly were the effects that needed to be understood on how to combat these challenges. There are only five games which were identified to have been accommodating the players with different cognitive disabilities and impairments. Through various different studies, it is indicated that many people with cognitive impairments do play various games, but it is very less known of the fact about what types of problems they are facing.

Metric—The accessibility of the games after being measured is known as to be very complex because of various factors. A possible way to enhance this problem would be to make games accessibility ratings for the games that are very likely the same as the Entertainment Software Rating Board [15] ratings. Then after these ratings, it would generally help all the disabled people with a sense that which game they can actually play with less number of hindrances and enjoy the gaming experience. In this way, they can buy various games and give their own opinions to enhance the credibility of the games. The accessibility ratings on the top of the gaming boxes will give rise to the potential and enhance the awareness needed for the need of accessibility in games for different types of disabled people and in fact for normal people also. This is all because the low-level techniques are context dependent and also depend a lot on the genre type of the game and following this many game can accessed for various genre types and thus new games can be developed over the course of time. These types of referencing games should be the most accessible game for all the types of disabilities and it should also allow how the accessibility of these

games can be measured. Well these accessibility ratings do provide an indication for each category of disabled people on a specific type of scale and thus it will act as the highest and most efficient rating for that genre type of a gaming series.

COST—Many people around the globe don't understand that people with disabilities also like to play the games that normal people play. The reasons behind this type of no awareness are that various schools do not include the development of games in their school curriculum because of the high cost of very good game development kits. Many schools term them as not a resource of an income as not every person can code. Many books are being published but only one book that talked about the game accessibility was this. Another reason for such a type of lack of awareness is that within the gaming world or industries the people think that they won't get enough profit out of the selling of games.

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