

Development of Video Games With WebGL Format That Allows You to Play Video Games Without Need for a Device With High Specifications

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ABSTRACT

The rapid development of the gaming industry has brought new challenges in terms of hardware limitations faced by some players. Nowadays, many video games require devices with high specifications to provide an optimal gaming experience. However, this left several players with devices that were unable to run these video games. This research focuses on experimenting with video games in WebGL format that can run well on devices with low specifications, thereby allowing wider access to a quality gaming experience. In this research, the author tested video game performance on various devices with different specifications in WebGL format. The test results show that this approach succeeded in achieving the author's goal, namely that the video game still can be played on devices with low specifications.

INTRODUCTION

WebGL itself is a web technology that provides accelerated 3D graphics in the browser without installing additional software. WebGL is an abbreviation for Web Graphics Library. WebGL is usually used for web design and web-based 3D video games. WebGL is also used by some researchers for scientific purposes.

As times progress, the video game industry has also grown rapidly over the last few decades, providing a variety of interesting experiences for millions of players around the world. However, this growth has also led to new challenges, particularly in terms of increasingly high hardware requirements for running video games modern. As video game technology advances, many video game titles today require devices with powerful specifications in terms of graphics, processing, and memory, leaving several players with devices that are unable to access an optimal gaming experience.

This research aims to overcome the problem of hardware limitations in the world of video games. The author focuses on developing video games in WebGL format which allows smooth play on devices with lower specifications because WebGL can run video games using just a browser. This is possible because WebGL has its own GPU to read graphics from video games and does not use the GPU of a personal device. This makes devices that run video games in WebGL format lighter than running video games in other formats.

METHOD

TOOLS AND MATERIALS

Technology Selection

The author started this research by using video game development technology in WebGL format. This technology was chosen for its ability to run in various browsers without the need for additional plugins, thereby allowing broad access by players with different devices. WebGL itself grew out of the 3D Canvas experiment started by Vladimir Vukićević at Mozilla. Vukićević first showed a prototype of 3D Canvas in 2006. By the end of 2007, both Mozilla and Opera had created their implementations separately. In early 2009, the non-profit technology consortium Khronos Group started the WebGL Working Group, with initial participation from Apple, Google, Mozilla, Opera, and others. In March 2011, WebGL 1.0 was finally released. With the release of WebGL, many multimedia application vendors such as Autodesk, Fusion 360, and AutoCAD 360 are enthusiastic about porting their applications to make WebGL even more sophisticated.

Video Game Genres

As technology continues to develop, many genres of video games have been published or released today. Starting from the Action, Sports, Role Playing Game (RPG), Shooting, and even Multiplayer Game genres, it has been applied to several popular video games that have been released in the last few years. For this research, the author will use a video game with the Shooting genre. The shooting genre itself can be divided into First Person Shooter (FPS) and Third Person Shooter (TPS). This time the author will focus on First Person Shooter (FPS) video games so that monitoring



graphical differences when running on different devices becomes more visible because video games with the FPS genre will focus on the scenery of the game itself. Overall, first-person shooter games, or the abbreviation for FPS apply a game concept that focuses on a first-person perspective which allows players to experience the sensation of playing in the game as if they were a character in the game.

SOFTWARE

The software that will be used in this research is as follows:

Game Engine Unity

The game engine is a software system that can be used to develop and create video games. The game engine itself is a library that can be used to create games. There are many choices of game engines that support the WebGL format, namely Godot, Unreal Engine, CryEngine, Unity, and many more. Each game engine has its advantages and disadvantages. In this research, the author will use the Unity game engine to process video games into WebGL format. With a user-friendly UI, so it is easy to learn and its size is relatively light compared to other game engines, Unity is the best choice for the author for this research. Unity itself also has lots of free additional libraries that can be downloaded, making research more efficient because there are lots of resources that can be used.

Google Chrome

Apart from Unity which functions as a game engine, the author also uses the Google Chrome web browser as a web browser which will later run video games in WebGL format. The Google Chrome that the author uses has version 118.0.5993.70 for desktops and version 117.0.5938.153 for mobile devices. In this version, Google Chrome supports the WebGL format so that video games can be run on the web browser. The internal memory storage of the device used to run video games also does not require a large amount of storage. This is because video games in WebGL format will be saved on an internet server so they do not require internal storage to store data from the video game being played.

Windows 10

The author uses a laptop with the Windows 10 operating system as the main development machine because Windows 10 can run the Unity game engine well. The user-friendly UI of Windows 10 makes it the operating system of choice for writers for daily activities when using a laptop.

Android version 8.1.0

The author also uses an older version of Android, namely version 8.1.0. The purpose of using this version of Android is that the author wants to test whether video games in WebGL format can also be run on previous versions of Android, namely version 8.1.0, and not the latest version of Android which has now reached Android version 13 since this research was created.

System Monitor Float Free application

The author will use the System Monitor Float Free application to check the temperature of the device that will be used to run video games in WebGL format, especially for Android devices with version 8.1.0. Apart from monitoring the temperature of the smartphone, this application is also able to display frame-per-second (FPS) data which will also be needed for this research when the video game is run in a web browser.

Real Temp Application

To check the temperature on the laptop hardware, the author will use an application called Real Temp. This application can display temperature data on a laptop properly and accurately when the laptop is in use. The Real Temp application is free and is compatible with various types of processors, one of which is the Intel Core i3.

HARDWARE

Laptops

The laptop the author uses has an Intel Core i3 processor, mid-range GPU, and 4GB RAM. This laptop is capable of running medium-level video games with left-aligned graphics and getting 25-30 FPS. However, when running high-level video games, this laptop often freezes and crashes responding and then forces close when a new game is opened. However, this laptop is capable of running video games slightly above medium level with left-aligned graphics settings and gets an average of 15 FPS while the video game is running.

Smartphones

The author will also test video games in WebGL format on an Android smartphone with a 2.0GHz Octa-core processor and using Android version 8.1.0 with 4GB RAM and 64GB storage. This smartphone is capable of running medium-level video games on the Google Play Store with left-aligned 30 FPS graphics. However, the video game will



be broken after 10 minutes of playing because the temperature of the smartphone also increases when playing video games for more than 10 minutes. With this increase in temperature, the smartphone is unable to maintain smooth video game performance while playing.

Performance Testing on Multiple Devices

Performance Testing

The author will test the performance of video games on each device by measuring frames per second (FPS), response time of the game, and temperature levels of the hardware used to run the video game.

Analysis of Results

Test results are used to evaluate the extent to which this video game can run well on devices with low specifications. The author compares these results with the research objectives to measure the success of this research.

RESULT

Game Development Results with WebGL Format

The author has rendered a simple First Person Shooter (FPS) video game in WebGL format using Game Engine Unity. The author also adds a stormy feel to the video game, making the video game quite heavy when played on devices with medium specifications when it is not rendered using the WebGL format. Even though it is quite difficult to run, this video game can still be played on left-aligned graphics and will get an average of 25 FPS when played. The video game has a size of 1.3 GB when rendered in WebGL format.



Figure 1. FPS video game that will be used as an experiment

This video game only has one scene, namely the scene seen in Figure 1. Other assets such as grass, trees, and an old empty building are also included to measure how smoothly the video game can run if many objects are added to the video game.

Performance Testing on Multiple Devices

Performance test results on various devices reveal significant differences in the devices' ability to run video games. The results are as follows:

Table 1. Test results on various different devices

No	Device	FPS	Response Time	Temperature
1	Laptop	40 FPS	36 Detik	63° Celcius
2	Smartphone	20 FPS	38 Detik	41° Celcius

Table 1 shows a comparison of the performance of each device for running video games in WebGL format, namely laptops and smartphones. The results show a significant difference in performance between laptops and smartphones for FPS and temperature, but not much difference in the response time of games.

Laptops

Laptops with mid-range graphics cards face challenges in running video games at full graphics or right-aligned graphics. However, the results showed that it stabilized at 40 FPS in high graphics scenarios and did not drop below it during play, but the performance of the video game increased to 60 FPS when the author reduced the graphics quality to left-aligned. The author also tried using formats other than WebGL on the same device. The results are at 25 FPS and sometimes drop to 20 FPS while the game is running on a laptop with the Windows 10 operating system. The response time for the game itself is quite long, namely around 36 seconds to load all the assets contained in the video game.



Many things can trigger a delay in response time for video games played in WebGL format, one of which is the internet network.

During the video game, the resulting temperature is 63o Celsius. The author also tried rendering the video game in Windows format to compare the temperature. With a different format, the laptop temperature increases drastically to 75o Celsius and the laptop fan even spins very loudly, which indicates that the laptop is working harder to read the assets in the video game. This can be said to be normal considering that the laptop's GPU works alone without the help of a web browser to load all the assets contained in the game being run.

Smartphones

Android mobile devices with 2.0GHz Octa-core processors also experience reduced performance. Results show a drop of around 20 FPS with lower graphic quality. When the author tries to increase the graphics to be right aligned or to the highest graphics, the browser sometimes freezes and cannot be interacted with. The game successfully loads all of its asset data when it is run, which takes a time not much different from when the game is run on a laptop, which is around 38 seconds.

The resulting temperature on a smartphone is around 41o Celsius in the CPU section which is located at the top of the smartphone. The author also tried to render the video game in a special Android format, but when running the video game it only displayed a white screen and could not respond at all when run on an Android device. The video game that the author designed for this research uses high graphics which may still be difficult to run on an Android device with 4GB RAM with a 2.0GHz processor.

DISCUSSION

Test results show that video games in WebGL format can provide quite good results on devices with medium specifications. However, devices with lower capabilities face challenges in running video games with full graphics. This indicates that further graphics optimization may be required to improve performance on low-performance devices.

This can happen because devices with low specifications have difficulty running browsers that support WebGL. After all, these browsers also consume quite a lot of RAM. The response time of the game is also greatly influenced by the internet speed of the players. The faster the internet speed, the response speed of the game will also increase considering that WebGL games are played on Web Browser devices which need internet speed to read all the data assets contained in the video game being played.

The temperatures produced on both devices are also considered very normal compared to when running video games in formats other than WebGL. Video games with formats other than WebGL require more performance because they will use components directly from the smartphone or laptop used to run the game. Meanwhile, for video games in WebGL format, the smartphone or laptop used to run the game will be assisted by the GPU provided by the web browser to run WebGL, making the components on each device lighter than other video game formats.

CONCLUSION

This research concludes that the development of video games in WebGL format is a positive step in supporting the development of the gaming industry in the future. Even though it has difficulty running on low-end Android devices, the video game can still be played at a lower FPS. However, video games in WebGL format can still be played by players, even if they only use left-aligned graphics settings. It's different if the video game is rendered in another format. With formats other than WebGL, video games often experience freezes and force closes when played even with left-aligned graphics settings, especially for low-end smartphone devices.

However, the results are different when run on a mid-range laptop. Video games can run quite well even though they only get 40 FPS when played at right-aligned graphics settings. Even though the GPU provided by the web browser to run WebGL is not as large as a high-end graphics card, the addition of a GPU from the browser makes the device running the game lighter because it is helped by the second GPU. As developments in the gaming world advance, the author believes that WebGL format video games will become a better choice for players with low-performance devices, and this will help reduce the access gap in the gaming world.

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