International Journal of Information Engineering and Science
Volume 2 Nomor 1 Tahun 2025
e-ISSN :3048-195; p-ISSN :3048-1902, Hal 17-27
DOI: https://doi.org/10.62951/ijies.v2i1.147
Available online at: https://international.arteii.or.id/index.php/IJIES

Comparative Investigation of Activity Rendering Utilizing Eevee, Cycles, and Radeon ProRender Procedures in Blender Applications

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Abstract. *The development of mixed-media technology has produced a variety of high-quality 3D animation techniques. This study examines the performance of three rendering techniques—Eevee, Cycles, and Radeon ProRender—based on rendering speed, visual quality, and memory efficiency. Tiga show 3D is rendered using the aforementioned ketiga technique and is compared in terms of speed, record size, bayangan, cahaya effect, and warning ketetapan. As a result, Eevee is unggul in kecepatan, while Cycles has the best visual quality, albeit being more lambat. Radeon ProRender provides impressive results, but it also excels in bayangan quality and cahaya effect. The use of Blender is recommended based on memory efficiency, graphic quality, or speed priorities.*

Keywords *Rendering, Eevee, Cycles, Radeon ProRender, Blender*

1. INTRODUCTION

Interactive media technology, particularly 3D design, is now the main focus of information technology. One essential tool that is increasingly being used in many different fields is 3D animation.(Ganga Rama Koteswara Rao et al.·2021) While rendering is a crucial step in producing realistic 3D images, render speed is the most important factor. A high-quality render can make time seem endless, even monotonous. While a poorly executed keras can hinder this process, a poorly rendered record can affect the quality and capacity of the project.

Blender contains two render motors, Eevee and Cycles, which produce high-quality visuals but can only be used within Blender. In contrast, Radeon ProRender is more flexible because it can be used with many 3D populer tools.(S. Dudek et al. 2022) Each mesin render offers different features, such as quality, kinerja, lisensi, and kecocokan with the relevant work schedule.

The author tries to compare Eevee, Cycles, and Radeon ProRender in terms of speed, memory efficiency, and visual realism. This study also examines the effects of weathering on bayangan quality, weathering effects, and warning accuracy on each render machine. By comparing visual differences and render time, this study aims to provide guidance in selecting render techniques that produce optimal results.

Received December 28, 2024; Revised January 12, 2025; Accepted January 26, 2025; Available online: January 28, 2025

2. LITERATURE REVIEW

a. Graphics

Rendering is a process that uses a computer program to create realistic or non-realistic images that show two or three dimensions. The result of this rendering process is referred to as render. Hasil Render can be either a raster graphic or an advanced graphic. The rendering process is usually carried out by converting the output of an image, video, music, text, or other object into a single utuh. Twelve Rendering is typically used to create complex visuals, test systems, films, animations, video diversions, and architectural designs. Techniques and features used in rendering bergntung for the project being worked on.(Alfain et. al. 2022)

b. Animasi

Animasi itself comes from the Latin word "anima," which means "jiwa," "hidup," and "semangat." On the other hand, karakternya refers to people, objects, or other things that are depicted in 2D or 3D images. Consequently, the character's animation As a result of the kumpulan gambar itu being beraturan and bergantian ditampilkan, it can be interpreted as a picture that depicts all objects that are part of everyday life. The objects in a picture can be written words, bentuk benda, words, or special effects.

Definition According to Ibiz Fernandes, animasi is a process of drawing and returning to a series of statistical illustrations in order to obtain a pergerakan illusion. Based on the aforementioned article, animation is a form of entertainment. That is, the business of pointing out something that cannot be bergerak on its own.(Olessia Barkovska et al. 2024)

c. Blender

Blender is a 3D graphic design tool used to create animated films, visual effects, 3D displays, interactive 3D applications, and video games. Blender is generally described as a free 3D creation package with a terbuka sumber. This program can also be used with a few different operating systems, such as Windows, MacOS, and Linux.(Dominik Schraml et al. 2024)

d. The Eve

Eevee is an acronym for Extra Easy Virtual Environment Engine, or also known as Mesin Lingkungan Virtual Ekstra Mudah in Indonesian. Eevee is a render mesin. real-time that is created using OpenGL and focuses on speed and interaction. Eevee may be used with 3D Viewport in a very subtle way and produces high-quality final renders.

Material Eevee is made using a shader node that is identical to Cycles, making it simple to render any existing adegan. Unlike Cycles, Eevee does not have a raytrace renderer. Alih-alih menghitung every cahaya sinar, and Eevee cahaya interacts with objects and materials using various algorithms. Eevee, on the other hand, is directed to use PBR principles.(Md Saikat Hosen et al. 2019)

e. Time Frames

Cycles is a ray-trace Blender-based render production tool designed to produce realistic and high-quality images. Cycles may simulate a scene in a very accurate manner that allows for the emergence of a visually striking effect, realistic rendering, and materials similar to those seen in Viewport 3D.

Cycles is designed to provide a high level of realism and may be used with either a GPU or a CPU. Using a technique known as path tracing, a worldwide computerized cahaya technique, the result is a very realistic image with accurate cahayaan. Cycles can produce cahaya effects such as depth of field, caustics, refleksi, and lembut bayangan, among others.6.(Aviv Fitria Yulia et al. 2024)

f. ProRender for Radeon

AMD RadeonTM ProRender is a rendering tool based on the AMD architecture that enables creative professionals to use industry standards to maximize GPU and CPU performance.producing a realistic-looking photorealistic image in Blender. RadeonTM ProRender is a Blender plug-in that is quick, easy, and versatile. It can be used to render anything, including product designs, architectural visualization, visual effects, and much more. (Ika Asti Astuti et al.·2022)

g. Modeling

3D modelling is the process of creating three-dimensional objects using a specific lunak technique known as 3D modelling. The object produced by this technique has dimensions of panjang, lebar, and tinggi, hence it can be seen to be similar to the object nyata. 3D modeling has become a staple in the creative industries, including video games, animated films, product design, architecture, and many more.8. (M. Seidler 2028)

h. Texture

Texturing is the process of applying a specific image to an object's surface so that it appears more realistic. Another way to put it is the process of identifying the object's permukaan characteristics. One of the characteristics is kilauan,coloring, and so on. Generally speaking, texturing can also be referred to as warning to the object's

surface orpainting, even if there is a process that alters the object's geometry. However, texture has a different art from texturing. One way to describe texture is as an actual warning image from a material that helps to explain or reassure utilizing a process known as rasterization. Texture can be described as an actual color image of a material that helps to explain or refine. (Eka Sahputra et al. 2022)

3. METHODS

In this research, the author used both experimental and analytical methods, including quantitative research methods. The method of quantitative research is a type of research that gathers data in the form of numbers or numbers and then analyzes it statistically.(Tiago Carneiro et al. 2018)

a. Eksperimen Method(Shichen Liu et al. 2020)

The experimental method is carried out using a 3D renderer that has distinct characteristics. Teknik Eevee, Cycles, and Radeon ProRender are the three distinct techniques that will be used in each demonstration.

b. Analysis of Methods(Wenzheng Chen et al. 2019)

Information about rendering time and memory usage is compared by utilizing the information rangkuman feature included in the Blender application. After that, an analysis will be conducted using the SPSS version 26.0 application and Expressive Measurement. In order to obtain information about the quality of the rendering of the results, the writer must examine and consider each detail in the results provide and carry out kuesioner penyebaran in order to conduct research using the Likert scale.

4. RESULTS

Rendering Hasil

This is the result of rendering using the Eevee, Cycles, and Radeon ProRender techniques:

a. 3D Homestay Hasil Rendering Model

The first 3D model created is a visual representation of a homestay.

1) Teknik Eevee Homestay rendering

After the render process is completed, the model homestay designer first uses the Eevee technique.

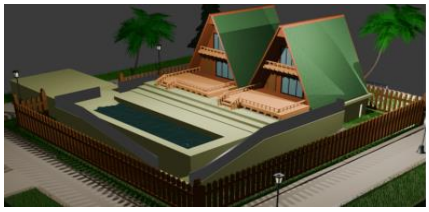

Figure 1. Result of Eevee rendering of the Homestay

As can be seen from the above illustration, the model that was rendered using the Eevee technique produced the illustration as shown.

2) Teknik Cycles Homestay Rendering

After rendering is complete, the model homestay is then rendered using the Cycles technique.

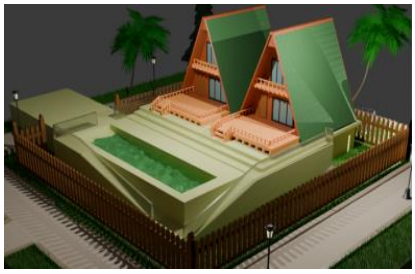

Figure 2. Results of Cycles Render Homestay Rendering

As can be seen from the above illustration, the model that was rendered using the Cycles technique produced the illustration that is shown.

3) Teknik Radeon ProRender Homestay Rendering

After rendering is complete, Model Homestay is rendered using the Radeon ProRender technique.

Figure 3. Redeon ProRender Homestay Render Result

As can be seen from the above illustration, the model that was rendered using the Radeon technique produced the illustration that is shown.

b. 3D Camping Hasil Rendering Model

The two 3D models that are rendered are visual representations of a camping area.

1) Teknik Eevee Camping Rendering

After rendering is completed, the first time the model is rendered is using the Eevee technique.

Figure 4. Eevee render result of Camping

As can be seen from the above illustration, the model that was rendered using the Eevee technique produced the illustration as shown.

2) Teknik Cycles Camping Rendering

After the render process is finished, the model camping is then rendered using the Cycles technique.

Figure 5. Results of Cycles render Camping

As can be seen from the above illustration, the model that was rendered using the Cycles technique produced the image that is shown in

3) Rendering Technique Radeon ProRender Camping

After rendering is complete, the model Camping is rendered using the Radeon ProRender technique.

Figure 6. Result of Radeon ProRender Camping rendering

As can be seen from the above illustration, the model that was rendered using the Radeon technique produced the illustration that is shown.

c. 3D Cafe Hasil Rendering Model

The rendered 3D ketiga model is a visual representation of a cafe building.

1) Teknik Eevee Cafe rendering

Model Cafe was first rendered using the Eevee technique after rendering was completed.

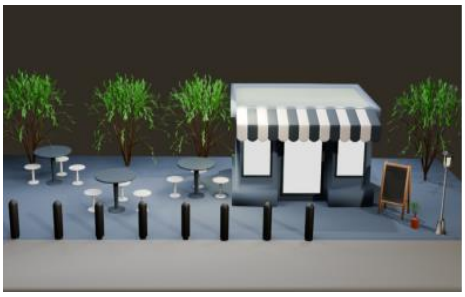

Figure 7. Result of Eevee rendering Cafe

As can be seen from the above illustration, the model that was rendered using the Eevee technique produced the illustration as shown.

2) Teknik Cycles Cafe rendering

After rendering is complete, the model Cafe is then rendered using the Cycles technique.

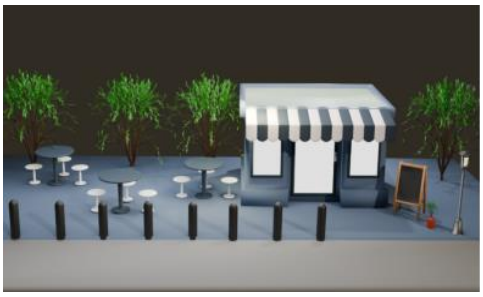

Figure 8. Cycles render results of the Cafe

As can be seen from the above illustration, the model that was rendered using the Cycles technique produced the illustration that is shown.

3) Radeon ProRender Cafe Rendering Teknik

After rendering is completed, the final model of Cafe is created using the Radeon ProRender technique.

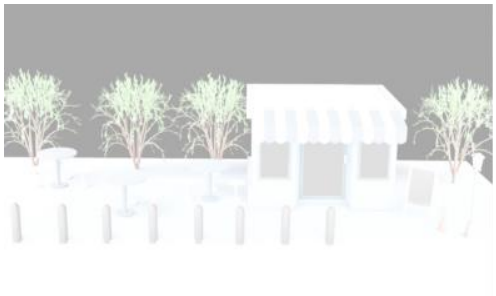

Figure 9. Result of Radeon ProRender Cafe rendering

As can be seen from the above illustration, the model that was rendered using the Radeon technique produced the illustration that is shown.

Penelitian Hasil

Based on the results of the analysis and the pengujian that were completed, the following research findings were obtained:

a. Kecepatan render time

The Eevee render technique shows the highest efficiency time with a rata-rata render time of 12,67 detik, but it's far more faster than Radeon ProRender (1194,33 detik) and Cycles (465,67 detik). Because of this, Eevee is seen as a good choice for projects that require high speed.

b. Hasil Render for Ukuran Files

The use of penyimpanan ruang for render files from ketiga techniques is not significantly different. Render file sizes are roughly 2.52 MB for Eevee, 2.66 MB for Cycles, and 2.74 MB for Radeon.

c. Hasil Render Quality

1) Eevee: Based on respondent questionnaires, the results of using the Eevee technique showed a nilai rata-rata of 79.17% (Baik). Eevee cocok for projects that require quick rendering times with good visual quality.
2) Teknik Cycles: Based on respondent questionnaires, the rata-rata is 87.50% (Sangat Baik). Cycles is a good option for projects that prioritize high visual quality even though it takes longer to produce.
3) Radeon ProRender: Based on respondent kuesioner, this technique yields a rata-rata score of 46.67% (Cukup). When compared to Eevee and Cycles, Radeon ProRender produces visual results that are quite lacking, particularly in terms of bayangan elucidation and cahaya effect.

d. Color Accuracy, Light Effects, and Shadow Quality:

1) Bayangan Kejelasan: When compared to Radeon ProRender, Eevee and Cycles produce bayangan that is more accurate and clear.
2) Efek Cahaya: Radeon ProRender provides a minimal cahaya effect, whereas Cycles provides the most realistic cahaya effect, which is created by Eevee.
3) Cycles and Eevee provide good warning ketetapan, but Radeon ProRender's warning ketetapan frequently deviates from the original.

5. DISCUSSION

Depending on the specific needs of a project, choose between Eevee, Cycles, and Radeon ProRender. Eevee is the best option for quick prototyping or projects that emphasize speed over detail. On the other hand, even if the rendering time is longer, Cycles remains a popular choice for projects that require images with high quality. Radeon ProRender functions as a useful alternative for people who want to balance work and quality, but it may also be necessary to adjust their work schedule to meet their needs. Understanding this difference might help the seniman create a keputusan that is appropriate for their project's needs.

Tabel 1. Summary of Comparison

Feature	Eevee	Cycles	Radeon ProRender
Rendering Speed	Fast	Slow	Moderate
Image Quality	Lower	High	Moderate
Usability	User-friendly	More complex	Requires adjustment
Best Use Cases	Game assets, interactive	High-fidelity visuals	Interactive viewport

6. CONCLUSION

Based on the results of the research and analysis that have been completed, the following goals can be achieved:

a. Eevee is a rendering technique that is efficient in terms of process time, making it a suitable solution to address issues that users of Blender sometimes encounter when rendering 3D, particularly when they encounter issues related to lengthy rendering. By using Eevee, users can speed up the rendering process without significantly lowering visual quality.

b. Visual details produced by the rendering technique Cycles produce the best results even though they require more time to render. Conversely, the Eevee technique offers a faster rendering time while maintaining high visual quality, making it a more efficient method of time management. However, in terms of penyimpanan efficiency, the render size of the results produced by the ketiga technique This does not indicate any significant differences, hence the ketiga technique has a relative set-aside performance.

c. When compared to Radeon ProRender, Eevee and Cycles produce more accurate and clear images. In terms of rendering effect, Cycles provides a realistic rendering effect,

which is influenced by Eevee, whereas Radeon ProRender displays a minimal rendering effect. In addition, Cycles and Eevee provide good warning ketepatan, but Radeon ProRender's warning results frequently deviate from the warning that was applied.

7. LIMITATION

Based on the results of the research that was completed, the following are some points that the author can make:

a. Pengembang can continue the study by examining several rendering techniques, whether complimentary or berbayar, such as V-Ray, RenderMan, and Arnold, to assess the features and accuracy of each technique.

b. Further research can be conducted using a computer with a wide range of specifications and a higher level of precision to investigate the effects of specific keras perangkat on render results. Specifically, using a CPU (processor) with:

The best option is AMD Ryzen 9 5900X or Intel Center i9-12900K.

The AMD Ryzen 7 5800X or Intel Center i7-12700K is the main specification.

Entry-level specifications: AMD Ryzen 5 5600X or Intel Center i5-12600K Using Smash

The best option is 64 GB DDR4/DDR5.

Menengah Pilihan: 32 GB DDR4

Entry-level Pilihan: 16 GB DDR4

Utilizing Capacity in this way:

The best pilihan is NVMe.SSD 1 TB or more (WD Dark SN850, Samsung 970 EVO Additionally)

SSD SATA 1 TB (Samsung 860 EVO, Significant MX500) is the storage device.

Entry-level Pilihan: SSD SATA 512 GB 3.Subsequent research can be carried out by creating a 3D display with a higher level of complexity, whether it be in the form of an animated or humorous movie.

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