3D INTERACTIVE ARCHITECTURAL VISUALIZATION OF INSTITUTE BUILDING USING UNREAL ENGINE

Dr. P. SIVAKUMAR
Professor
Information technology
Manakula Vinayagar Institute of
Technology Puducherry, India

M. PRAKASHRAJ
UG Scholar
Information technology
Manakula Vinayagar Institute of
Technology Puducherry, India

R. VASANTHAGANESH
UG Scholar
Information technology
Manakula Vinayagar Institute of
Technology Puducherry, India

S. GOKULAN
UG Scholar
Information technology
Manakula Vinayagar Institute of
Technology Puducherry, India

*Corresponding author mail id: rajmaniprakashraj@gmail.com

ABSTRACT - **This Project investigated the potential of the Unreal Development Kit (UDK) for architecture visualization. Architectural data was transformed into UDK assets using a workflow improvement using the Sketchup Tool to produce a time- and money-saving solution. The UDK was enhanced with a modular framework that offers the following features: changing surroundings, time of day visualization, Exterior lighting, fundamental architectural shaders, and a user interface. A demonstration prototype for visualizing a minimalist institution was created using the technique. Qualitative user research was conducted to assess the prototype. The project's goal was to depict the process of building an interactive, playable virtual model that was also photorealistic inside the Unreal Gaming Engine. A playable game exhibiting a building's outside, and interior was another objective. The theoretical portion of the paper concentrated on the subjects and issues that needed to be addressed to create a virtual model that can be played. The theoretical portion also featured brief training on how to use Unreal Engine's fundamental tools as well as explanations of the various themes. A virtual model was developed to help people comprehend the software and related subjects better. Everything else was created fully within Unreal Engine, aside from the base model.**

Keywords: 3D visualization, Unreal Development Kit, 3D rendering, Architectural Visualization, 3D model.

I. INTRODUCTION

The use of visuals in presentations has long been important in the architectural industry. These constructions frequently cost several million dollars. Clients must be persuaded that the architect's proposal is the finest one. Real-time visualization enables clients and architects to talk about every detail of the proposed design [2]. Many smaller 3D production studios concentrate solely on rendering 3D still photos and animations. Compared to traditional animation, creating an interactive 3D environment is more difficult and expensive. The expense of building (or licensing) a real-time 3D engine solution and the requirement for a big team size must be considered by the studio [1]. The 3D artists also need to be taught how to use the software and produce suitable 3D materials as needed by the 3D engine. Licensed 3D engines must also be altered to fit each unique use case, and they typically only function on specialized hardware. A 2D or 3D rendering solution is often part of a gaming engine's basic functionality. Over the past few years, rendering technologies have dramatically improved to the point that almost photorealistic renderings are now possible in real time. In addition to the advantage of inexpensive licensing fees, the hardware requirements are not onerous. The quick pre-visualization of intricate animation is made possible by the integration of game engine technologies into a 3D animation workflow.

The 3D gaming engine technology can be used to Architectural Visualization. In most cases, visualization concentrates on a building's interior or exterior, and the spectator is constrained by still photos or animations to observe the structure from a particular vantage point and during a particular period of the day. Both styles of visualization can be combined into one experience by developing an interactive visualization.

Viewing through the rooms, dynamically replicating different times of day, room arrangements, or weather conditions allow one to experience the building. A huge crew is used in game development to produce a game. Although it is a relatively specialized application, it is possible to construct a system that can be used by a small team or a single individual to produce visualizations in the case of architectural visualization.

II. RELATED WORK

The existing system mapped the development and workflow of a virtual model that could be played and interacted with inside of the Unreal Engine gaming engine [2]. Interactive Architectural visualization using unreal engine, Author Susi_Jakko created a playable game exhibiting both the interior and exterior of a commercial building. That building that was used sin the finished product was designed by Treedee Oy, who also commissioned the project. The structure will be constructed in Hainan, China. The theoretical portion of the project concentrated on the subjects and themes that needed to be addressed to create a virtual model that could be played. The theoretical portion also featured brief training on how to use Unreal Engine's fundamental tools as well as explanations of the various themes. A virtual model was developed to help people comprehend the software and related subjects better. Everything else, save the base model, was created fully within Unreal Engine [1]. A 3D architectural visualization system in use today is Typically, blueprints and illustrative photographs are used to store information on a building's external design arrangement. This information can be used to model the structure and show how different rooms are utilised. Only for the commercial purpose of buildings, it enables the production of intelligent 3D models that may be used for analysis, simulation, and visualization.

III. SCOPE AND METHODOLOGY

We can go over the details and subjects addressed in this article in more detail in this part. Next, we go over the technique this study will use.

Scope:
There are many desirable 3D modelling jobs accessible in the animation, advertising, architectural, engineering, and other areas if you have experience with one or more 3D modelling programmes. 3D modellers, perhaps. jobs that are either full-time, part-time, independent, or freelance.

Our Scope is any teams can build any shape they can imagine using 3D models while still maintaining production capabilities, which makes it easier to realise ambitions. Modern 3D modelling, such as better control over details, offers a level of design depth that is not possible with rough sketches or 2D designs.

Methodology:
The process of constructing a 2D image or animation from a prepared scenario is known as rendering. This is comparable to after the setup is complete in real life, taking a picture or capturing the scene. From the obviously unrealistic wireframe rendering through polygon-based rendering to more sophisticated methods like scanline rendering, ray tracing, or radiosity, these cover the entire rendering spectrum. For a single image or frame, rendering could take a few hundredths of a second to several days.

Different techniques are typically more effective for either real-time rendering or photorealistic rendering. Many sectors now depend heavily on 3D rendering. Everyone is adopting 3D rendering and visualization to enhance their business, from retailers to manufacturers. The most effective way to communicate concepts to the client and users is frequently through 3D models and visualizations. Building information modelling, or BIM, is typically used to represent the buildings, and as a result, a 3D model is also available.

Types of Rendering:

(i) SCANLINE RENDERING:
Solve the hidden surface problem for just that scan line by intersecting each polygon with a specific

2756

scanline. needs a depth buffer with a single scan line's worth of space. requires the complete scene data at scan conversion time. Keep a list of active edges and polygons active. can include antialiasing in its algorithmic execution.
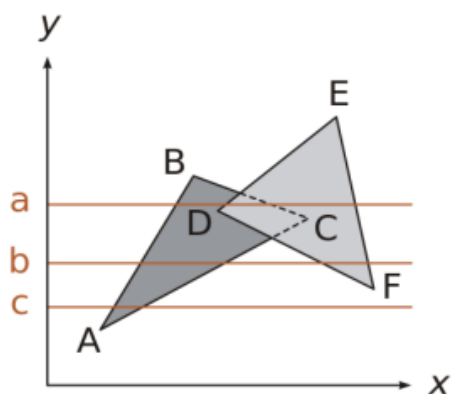

Fig. 1.1 Scanline Rendering.

(ii)PHOTOREALISTIC RENDERING:

PR is a software-based method that uses a 3D CAD model to produce a digital image of the model. The result is a produced image that is difficult to tell apart from a picture of an actual object.

Fig. 1.2 Photorealistic Rendering.

IV. PROPOSED SYSTEM

Instead of viewing the most basic representation of our college in a 2D format, our proposal system would construct an interactive 3D visualisation building for it and offer a photorealistic rendering notion. By using realistic materials and details, we can beautifully illustrate our client's proposed designs and communicate their stories. Future architectural designs and 3D architectural visualisation will enable projects to be created, altered, and improved in real time before being constructed. clients can now sell their designs to potential clients without incurring extra fees or time-consuming project revisions.

Through 3D visualisation, finely detailed embellishments like vegetation, lighting, and people add to the richness and engagement of architecture and the landscape it is surrounded by simulation and an architectural view are produced. For our institute, we develop the working simulation-based software (ARCHVIZ) and an architectural view. By offering an outside design and allowing users to choose an internal design by choosing a floor, a class, or an auditorium. By adding user-friendly features, we may make our software's user interface interactive for students and faculty members.

The first step is to collect accurate and comprehensive data about the college buildings. This data will include architectural plans, elevations, and sections, as well as information about the materials and textures used in the construction. After collecting the data, the next step is to create a 3D model of the college buildings using Unreal Engine.

This can be done by importing the collected data into Unreal Engine or by creating a new model from scratch. The 3D model should be designed with accuracy, ensuring that the dimensions and proportions of the buildings are correct. Once the 3D model is created, the next step is to apply appropriate textures and materials to it. This will include materials for walls, floors, roofs, and other building components. The lighting system should also be designed accurately to simulate the real-world lighting conditions of the campus.

Interactive elements such as doors, windows, and other movable parts should be implemented to allow users to interact with the 3D model. Navigation controls such as camera movement and user controls should also be integrated to provide a seamless user experience. A user interface should be designed that is intuitive and easy to use. The user interface should provide information about the buildings and allow users to navigate through the different areas of the campus.

Overall, the proposed system will offer a 3D visualisation of the college buildings that is immersive and interactive, allowing users to

experience the campus setting in real-time. Users should be able to access the system on their smartphones or tablets if it is mobile device optimised.

To make sharing and access by authorised users simple, the system should be created to store the 3D models and related data on the cloud. The system must be able to offer analytics and reporting on user activity, including details about which parts of the campus are visited the most frequently, how long visitors stay in each location, etc. The college will profit from this by having a distinctive and creative approach to showcase its campus structures and resources, luring more potential students and staff members.
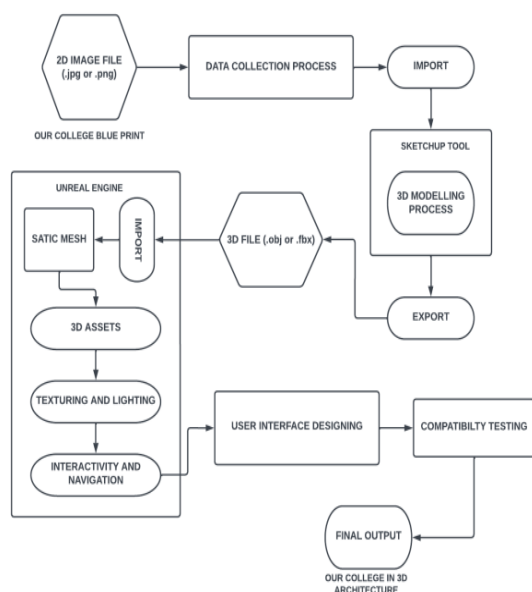

Fig. 1.3 Architectural Diagram for Proposed Work.

V. IMPLEMENTATION

The implementation of project work is to create a 3D architectural visualization of institute building using Unreal Engine, Gather reference materials such as architectural plans, elevations, and photos from college blueprint plans. Model our building in a 3D modelling software such as Blender & Sketchup which is free open-source software for 3D modelling and import it into Unreal Engine. Apply materials, lighting, foliage, and environment elements to create and achieve photorealistic environment. Finally Test and iterate our work, then finalize and render high-quality application which is useful for the Institute Students, Teachers, and related people.

Gather reference materials: Collect all necessary reference materials such as architectural plans, elevations, and sections of institute building. We were used our institute blueprint for reference.

Model your building: Use a 3D modelling software such as SketchUp, or Blender to create a detailed 3D model of institute building and make sure that the model is accurate and includes all necessary details.

Import your model into Unreal Engine: Once the model is complete, import it into Unreal Engine by export the 3D model as an FBX file from the blender software and import it into Unreal Engine and configure the project settings for working.

Add materials and textures: Apply appropriate materials and textures to the model and make it look more realistic. We can use the materials and textures provided by Unreal Engine and created some textures and materials own using the Material Editor.

Set up lighting: Lighting is critical for creating a realistic architectural visualization. Set up the lighting in Unreal Engine using either static or dynamic lighting depending upon the environment needs.

Add foliage and environment: To make our visualization more realistic, we can add foliage and environment objects such as trees, grass, and other outdoor elements.

User interface: A user interface should be designed that is intuitive and easy to use. The user interface should provide information about the buildings and allow users to navigate through the different areas of the institute.

Test and iterate: Test our visualization and make necessary changes to ensure that it is accurate and meets our requirements.

Finalize and render: Once we are satisfied with our 3D visualization, we can render high-quality 3D software for students, teachers, and related people or marketing purposes.

2758

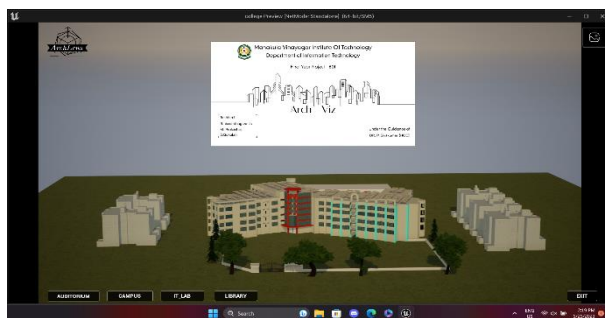Eur. Chem. Bull. 2023, 12(Special Issue 7), 2755-2760

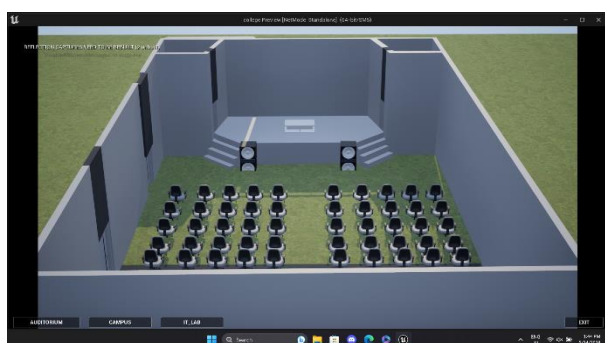Fig. 1.4 Exterior Preview for Our Proposed Work.

Fig. 1.5 Interior Preview for Our Proposed Work
(Asset – 1)

Fig. 1.6 Interior Preview for Our Proposed Work
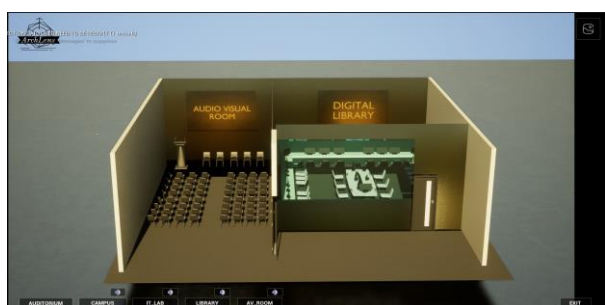(Asset – 2)

Fig. 1.6 Interior Preview for Our Proposed Work
(Asset – 3)

VI. CONCLUSION

To sum up, the use of Unreal Engine for 3D Interactive architecture visualisation is a potent tool for producing immersive and captivating experiences that can aid in bringing architectural plans to life. Unreal Engine provides a flexible and dynamic environment for researching and exhibiting architectural projects with its capacity to generate high-quality images, add realistic lighting, and develop interactive features. Students, teachers, and visitors can gain a completely new perspective on a institute building by developing a 3D Interactive architectural visualisation project that is specifically focused on that facility. Through the initiative, users will be able to take a virtual tour of the structure, interact with its various components, and experience the design in a way that is not feasible with conventional drawings or photos.

It is crucial to plan meticulously, produce accurate and thorough 3D models, optimise the scene to ensure good performance, and thoroughly test the project to find and fix any potential problems. The most cutting-edge technology advancements are what will determine the entire future of contemporary architecture and the market for architectural visualisation. For students, our college will assist in providing an interactive visualisation. It will be beneficial for incoming students who have just started classes at our university. They are advantageous to all market participants. However, the lack of infrastructure for 3D technology may impede development. Future advances in this field are anticipated to be highly exciting now that the world is aware of how architectural visualisation may be used as a crucial marketing tool.

A useful tool for architects, designers, and anybody else interested in the topic of architecture, 3D Interactive Architectural Visualisation utilising Unreal Engine can offer an original and interesting approach to study and exhibit architectural projects.

VII. REFERENCES

[1] Jaakko Susi. Interactive Architectural visualization using unreal engine. Creation of a Virtual Model. Thesis – bachelor's degree programme technology, communication, and transport. April 3, 2022.

[2] Unreal Engine 4.27 Documentation. 2021. Internet publication. https://docs.unrealengine.com/4.27/en-US/. Accessed between 3.2.2021-18.12.2021.

[3] How to Create a 3D Widget. 29 Sept 2020

Arch-Viz Course 1. https://www.youtube.com/watch?v=1rfHC3Xz6OM.

[4] Display A Prompt Above An Item In-Game - Unreal Engine 4/5 Tutorial.30 Apr 2022 https://www.youtube.com/watch?v=tob3GEdMJFc.

[5] How To Switch between sofa options using widget button. 6 Oct 2020 Arch-Viz Course 1. https://www.youtube.com/watch?v=sl0U-3RCJZs.

[6] Unreal Engine 5.2 for ArchViz - 2023 Full Beginner Course. 30 Apr 2023 UE5 https://www.youtube.com/watch?v=bT8aSTkpkDY .

[7] Creating Arch Viz IOS iPad app - Unreal Engine & blender. 6 Mar 2022 Arch-Viz Course 2 https://www.youtube.com/watch?v=LMpaZIl3WdA.

[8] VR Division. 2021. Unreal Engine Master Class. Course.

[9] Polygon University. 2019. How to Get High Quality Reflections in UE4: Quality and Performance Tutorial. Internet publication. https://www.youtube.com/watch?v=Fqw5c6Ow1xA. Accessed 23.5.2021.

[10] Architectural Visualization. 2020. How to use Backdrop plugin to change light and background in Unreal Engine | Unreal Engine tutorial. Internet publication. https://www.youtube.com/watch?v=jwZi0KVebo4. Accessed 30.3.2021.

[11] Unreal Engine. 2019. Interactive Architectural Visualization in Unreal Engine | Autodesk University 2019 | Unreal Engine. Internet publication. https://www.youtube.com/watch?v=o_2Q5y1AXVI . Accessed 22.8.2021.

[12] Unreal Engine. 2020. Achieving Higher Visual Fidelity with Ray Tracing | Unreal Fest Online 2020. Internet publication. https://www.youtube.com/watch?v=wv5UeSZST5w. Accessed 14.8.2021

[13] Unreal Sensei. 2020. Unreal Engine 4 Beginner Tutorial - UE4 Start Course. Internet publication. https://www.youtube.com/watch?v=_a6kcSP8R1Y. Accessed 4.2.2021.

[14] Unreal Sensei. 2020. The Secret to Realistic Landscapes in Unreal Engine - UE4 Tutorial.

Internet publication. https://www.youtube.com/watch?v=UIycCZl4lYE. Accessed 15.3.2021.

[15] The Revit Kid. 2021. From Revit to Unreal Engine - Step by Step. Internet publication. https://www.youtube.com/watch?v=arC1aUMgZyw. Accessed 17.3.2021.

[16] 3D Motive, Modular Building Worklow. 21. Mar. 2013. https://www.3dmotive.com/f101001 3ds Max 8 Architectural Visualization, Brian L.Smith.

[17] Epic Games, Introducing Unreal Engine 5 Dec. 2012. http://www.unrealengine.com/unreal_engine_4/.

[18] Epic Games, Introduction to UDK Training Videos, 2007.

[19] Epic Games, Landscape Creation, 20. Mar. 2013. http://udn.epicgames.com/Three/LandscapeCreating.html.

[20] Epic Games. Epic Games Announces the Unreal Development Kit Powered by Unreal Engine. 1.10.2012 http://www.udk.com/launch.

[21] Escape Studios, VFX Career Bible, 2013. [11] Papam Studios. UDK Study: Day cycle Simulation, Work in Progress. 1. Nov. 2012 http://www.papamstudios.com/projects.html

[22] Perforce, Software Version Management, 20. Mar. 2013. http://www.perforce.com/

[23] Preview of Autodesk Ecotect Analysis 2010, 27. Mar. 2013. http://www.youtube.com/watch?v=BKZ35xh4ofw

[24] Prof. Dr. Hermann Parzinger, Neuordnung der Kunstsammlungen der Stiftung Preußischer Kulturbesitz, 30.Nov.2012. http://www.rotary1940.de/berlin/00_aktuell/parzinger_kunstsammlung.php.

[25] How To Change Material in Real Time using a Widget. 10 Sept 2020 Arch-Viz Course 1 https://www.youtube.com/watch?v=srlSbDDLHco