

3D GAME DEVELOPMENT USING UNREAL ENGINE

Anuradha M. Sandi^{1*}, Abdul Qadeer Makki², Krutika S³, Mahadevi⁴

Department of Computer Science and Engineering
Guru Nanak Dev Engineering College, Bidar-585401 Karnataka, India
Visvesvaraya Technological University, Belgavi-590018

Abstract - Nowadays, Unity and Unreal Engine has been the top two software that been used in the game industry to create, teach, and learn by many huge companies or individuals to create games. However, not many people know which program to learn or where to pick up when they want to get into the industry and become a game programmer [1]. Unity is a professional and multi-platform gaming engine. It has become very popular in recent years. It has audio, video, graphics, lighting effects, and physical effects that can simulate the physical world, making the user feel immersive. Unity has gain popularity because of its rich community. It has in built physics and rigid body features that make it unique from other game engines[2]. The journey begins with an exploration of unreal engine interface and core functionalities, including scene creation, asset integration, and scripting using C# as well as lua programming language.

Techniques such as level-of-detail (LOD) optimization, asset batching, and code profiling empower developers to deliver high quality experiences without sacrificing performance. This analysis reflects the adaptability of game engines to different teaching styles and provides insights into their effectiveness as tools for teaching game development and computer science[6].

Keywords: Game development, Unreal engine, User interface, Game design document (GDD), Scripting.

1 INTRODUCTION

Unreal engine stands as cornerstone in the realm of game development, it allows developers with a comprehensive suite of tools for creating high quality 3D games, empowering creators to bring their imaginations to life in three-dimensional worlds. Launched in 2005, Unreal engine quickly became a go-to platform for developers worldwide due to its user friendly interface, powerful features, and versatility across multiple platforms.

Unreal Engine is a game engine developed by Epic Games, first showcased in the 1998 first-person shooter game “Unreal”. Initially developed for PC first person shooter, it has been successfully used in a variety of other genres, including plat formers, fighting games, MMORPGs and other RPGs as well. Written in C++, Unreal Engine features a high degree of portability, supporting a wide range of platforms (Unreal Engine, Wikipedia). Unreal Engine is a complete suite of creation tools for developing from independent hits to blockbuster franchises. Unreal Engine delivers high quality which makes many studios choosing it to develop fantastic projects in video games or even movies and films because of its proven performance. Over the course of 2 decades with many system updates, Unreal Engine has become one of the two most trusted and reliable engines in the world[1]. Underneath the surface game-play, video games are fundamentally about making decisions and exercising skills. A car racing simulation involves a great deal of skill in controlling the vehicle along with decisions involving the choice and setup of the vehicle. Real-time strategy games, while varying greatly in content and style, are unified by a set of common decisions that their players make. These decisions involve a variety of challenging problems that players are simultaneously solving: resource allocation, developing their economy; force composition, training and equipping an effective military; opponent modelling - estimating the location and composition of enemy forces; spatial reasoning - predicting incoming attacks or defensive vulnerabilities, while hiding and misleading their enemies about their own intentions[3].

By using a number of experimental maps created in the Unreal Tournament 2004 Editor, modified to remove the aggressive elements in the HUD (Heads Up Display), this paper will present an analysis of the emergent ontological qualities of working and thinking in a game-space, as distinct from those spaces currently typified as the technical domain of avant-garde architectural practice – complex geometry and NURBS modelling. The ability to create and script an environment that is present and interactive fundamentally transforms

the manner in which architectural design may be approached. Beyond the fascination with complex geometries for their own Game engine software in the architectural design studio sake, the manner in which the use of game-engine software is a performative medium gives it a temporality and indeterminacy absent from more controlled representations[4]. At its core, unreal engine 3d provides a comprehensive suite of tools and workflows tailored to streamline the game development process.

Mastering Unreal Engine will teach you exactly where to begin. You will learn how to download Unreal Engine, construct your first game, start your game, receive an introduction to blueprints, and ultimately, develop a workable framework. Unreal Engine is a complete development suite for anyone working with real-time technology when it comes to game development. It provides flexibility and power to artists across many sectors to generate cutting-edge entertainment, engaging visualizations, and immersive virtual environments for games and infotainment alike. Unreal Engine is a prominent game creation engine that is free to use. The majority of people associate Unreal Engine with 3D games. However, it may also be used to create 2D games with ease. It is the de facto standard in the world of game development. That said, it is not hard to be confused when getting started with Unreal Engine because of the wide range of features that it provides[5].

Computer games and, of course, especially their development, are a significant part of computer science. Modification or change of some procedures in game development is necessary due to modern technologies. In this sense, the development of technical means, especially graphics adapters, is advancing, for example, the possibilities of computer graphics as an essential component of computer games. On the other hand, the opportunities and problems of graphics libraries and engines define the need and maximization of graphics adapters' use. This aspect explains a significant synergistic connection between computer science and computer games. This connection is also reflected in the basic architecture of the currently standard gaming computer system[6].

In this introduction to unreal engine 3D, we embark on a journey into the heart of game development, exploring the tools, features and principles that makes unity a powerhouse in industry. Whether you are a seasoned developer or a newcomer to the world of game creation, unity offers a gateway to unleash your creativity and craft unforgettable experiences for players worldwide.

2 RELATED WORK

The landscape of unreal engine 3D game development is enriched by a plethora of resources spanning technical tutorials, academic research, community forums, case studies, and educational materials. Technical tutorials and documentation abound online, proving developers with comprehensive guides covering scene creation, scripting, optimization, and deployment. These resources cater to developers of all levels, offering practical advice and code samples to facilitate learning and implementation.

When teaching game design and development, introducing game theory can enhance students' understanding of game mechanics, dynamics, aesthetics, balance, etc. Utilizing game engines in the classroom provides an excellent platform for practically applying game theory concepts. For instance, students can use game engines for prototyping and testing different game mechanics while observing the result of various strategies and interactions and effectively experiencing game theory in action. While this chapter focuses on the role of game engines in teaching game design and development, the interplay between these engines and game theory underpins the educational potential of these tools. As students learn to use game engines, they inherently deal with game theory concepts, bringing abstract mathematical models to life [6].

The video game industry has been growing fast with the expanding number of users and the use of new innovations on gaming platforms starting from smart phones to Wii u console, virtual reality console, PlayStation, Xbox and other devices. In Finland, the game industry has certainly risen after the two successful companies over the past five years pushing a 100-million-euro industry to two billion. Rodio Entertainment (the creator of Angry Birds) and Super cell (the creator of Hay Day and Clash of Clans) are both based in Finland. These companies are examples of Finnish startup companies that grew into large game publishing companies. There are several opportunities and potential career paths for game developers in Finland. This is one of the reasons for choosing the thesis topic in

addition to the author's personal interest the game development field[7].

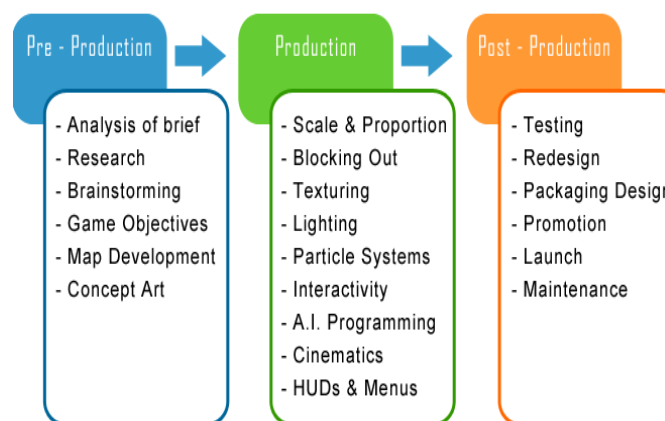
The Unreal engine is a main competitor of the Unity engine and it is also widely used for game developments. Both of these engines have their own strengths and shortcomings, but there were comparisons made between the two engines before choosing Unity for this project. Unreal engine 4 uses the programming language C++ and Unity engine uses C#. Due to the developer's prior experience and preference, C# was more preferred. The other comparison made was concerning the Asset store, Unity has a wide variety of numerous assets compared to Unreal engine. This was advantageous hence it is time taking to develop everything for a game, and asset stores will efficiently be used throughout the development process. On the other hand, Unreal engine offers a high level graphics compared to Unity. However, high graphics quality was not required for this game. Due to this and the above mentioned factors Unity was found to be a better choice for this project. The other main reason Unity was chosen for this project was for its cross platform development feature. Even though Unreal engine has the same feature, it supports 15 platforms whereas Unity engine supports 27 platforms. The project members' skills and experience using the game engine was also an additional factor [7].

Additionally, developers often publish case studies and post mortems detailing their experiences, challenges, and insights gained during the development of unreal engine-based games. These real world examples offer valuable lessons in best practices, design principles, and development workflows, providing inspiration and guidance for aspiring developers. Furthermore, an abundance of game development books, online courses, and educational resources are available to those seeking structured learning paths and comprehensive coverage of unreal engine 3d game development.

3 METHODOLOGY

The methodology for unreal engine 3d game development project involves a systematic approach aimed at efficiently progressing from initial concept to final product. It typically begins with project planning and conceptualization, where the game concept, genre, target audience, and key features are defined. Market research is conducted to identify trends, competitors, and potential opportunities, followed by the development of game design document (GDD) outlining game play mechanics, levels, characters, art style, and storyline.

Once the concept is solidified, project moves into prototyping and iteration phase. Here, a minimal viable product (MVP) or prototype is created to validate core gameplay mechanics and concepts. Feedback from playtesting sessions is gathered and used to iterate on the design, refining game mechanics, controls, and user interface to enhance player experience. Asset creation and integration come next, involving production or acquisition of assets such as 3d models, textures, animations, sound effects, and music. These assets are then integrated into unity project across target platforms. Scripting and gameplay implementation follow, where scripts are written using C# or another supported language to implement gameplay features, AI behaviour, and game logic. This involves implementing player controls, character movement, collision detection, and interactions with game environment, along with rigorous debugging and testing to ensure functionality and address any issues or bugs.



The project progresses with level design and environment creation, where game levels are designed, including layout, obstacles, puzzles, and objectives. Environments are built using unity's scene editor, with assets, terrain, and props placed to create immersive worlds. Lighting, shaders, and visual effects are fine-tuned to enhance atmosphere and aesthetics.

Testing and quality assurance are critical stages, involving comprehensive testing to identify and address bugs, glitches, and performance issues. Usability testing is also conducted to evaluate player experience and gather feedback on gameplay, controls, and overall satisfaction, with iterative adjustments made based on testing results. The gameplay is then polished and optimized, with final touches added such as particle effects, animations, UI animations, and sound effects. Performance optimization is also carried out to ensure smooth gameplay, frame rate optimization, asset compression, and memory management. Final rounds of testing are conducted to ensure the game meets quality standards and performs well on target platforms.

Finally, game is deployed and distributed, with platform-specific settings configured, and the packaged for release on various platforms such as PC, console, mobile, or web. Ongoing support and maintenance are provided post-launch, with updates and patches released to introduce new features, content, or enhancements based on player feedback and market trends.

4 RESULTS

The result of a unreal 3d game development project is a culmination of meticulous planning, creative design, and technical execution, all converging to deliver an immersive and engaging gaming experience. At its core, lies a playable game that embodies the envisioned concept outlined in the game design document (GDD). This game features a rich tapestry of visual and audio assets, meticulously crafted or seamlessly integrated into unity, providing players with visually stunning environments, characters, animations, and immersive soundscapes. The gameplay is smooth and responsive, characterized by intuitive controls, well balanced mechanics, and fluid character movements, ensuring that players are drawn into the game world from the moment they start playing.

In Unreal Engine, plugins are collections of code and data that developers can easily enable or disable in the editor on a per-project basis. Plugins can add gameplay functionality at runtime, change built-in Engine functions (or add new ones), create new file types, and extend the editor's capabilities with new menus, toolbar commands, and submodes. Many existing UE4 subsystems have been designed to be extensible via plugins. Plugins with code will have a Source folder. This folder will contain one or more module source directories for the plugin. Note that although plugins often contain code, this is not actually a requirement[8].

Moreover, if applicable, the game delivers a compelling narrative experience, driven by engaging storytelling, meaningful character interactions, and clear objectives. The user interface and experience are designed with careful consideration, offering intuitive menus, informative heads-up displays, and seamless navigation, enhancing player immersion and accessibility. Through rigorous testing and iteration, the final result is polished to perfection, free from bugs, glitches, and performance issues, ensuring a seamless and enjoyable experience for players. Finally the completed game is packaged and deployed for distribution across various platforms, adhering to submission guidelines and requirements, thus reaching players worldwide and leaving a lasting impression of creativity, innovation, and entertainment.

SKY VIEW



THIRD PERSON PERSPECTIVE (TPP)



TERRAIN VIEW





5 CONCLUSIONS

In conclusion, the completion of this Unity 3D game development project marks a significant milestone in our journey to create an immersive and engaging gaming experience. The Unreal Engine 5 offers the most features of all found engines that are relevant for this project. The compatibility of these features is thoroughly proven by the community; we don't run the risk of having to use unverified and unpredictable 3rd party Components[3]. Through meticulous planning, creative design, and technical expertise, we have successfully transformed our initial concept into a fully realized game that captivates players and delivers on our vision.

The main approaches to the implementation of software tools were described. The Unreal Engine tools used to develop the interface component of the editor, as well as engine debugging tools and a tool for viewing and obtaining additional information about the Unreal Engine editor widgets, are considered. In the work, the architecture of the structure of the windows of the Unreal Engine editor and the methods of extension of toolbars and menus were disassembled [8].

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