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The Dharma Engine: A System for Dynamic Narrative and Real-Time World Changes in Unreal Engine 5

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Abstract: Even though players have more options in which to take an action, the world does not change based on their narrative choice. Usually, changes in dialogue or ending are brought through decisions made. The physical environment was generally not reactive. When immersion is lacking, the player's action is weak. This paper presents the Dharma Engine, a new framework that connects player morality to the transformation of the environment. The system, which combines gameplay logic with Lumen Global Illumination and Nanite Virtualized Geometry, is built in Unreal Engine 5. The Dharma Score is a fundamental element that monitors the decisions of players in real-time. When things cross a threshold, the engine sees changes with lights, architecture and world state. Through A.U.M. (Ananta Undestined Moment), a prototype referenced from the Mahabharata. The player plays as an "Undestined" character and has the ability to change fate that was unavoidable. The experimental results, linking moral choice with environmental feedback enhance immersion significantly. A life path that offers an event and activity-driven emergent gameplay and storytelling and where the world reacts.

***Keywords*:** Procedural Narrative, Unreal Engine 5, Dynamic Environments, Lumen Global Illumination, Nanite Virtualized Geometry

1. Introduction

Video games stories have gone a long way. Role-playing games are the type where player's choices matter. Although there have been advancements in AI dialogues, these games still mostly rely on a scripted branching narrative where the world environment does not change. It is known as the static world problem. The Dharma Engine system proposes that the morality of the player

Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707

transforms visual and structural changes in the game world. The player is an "Undesigned Agent" who can change destiny by actions drawing inspiration from philosophical ideas from the Mahabharata.

The goal of the Dharma Engine is to use gameplay logic combined with real-time rendering technology to achieve this responsive world.

2. Review of Literature

Table 1. Systematic and UE5 Technical Capabilities

S.No	Author	Year	Publication	Parameter	Remark
1.	Koenitz et al.	2023	Routledge	Interactive Digital Narrative	Rejects dialogue trees; favors procedural world-based agency.
2.	Murray	2024	The Future of the Holodeck	AI-Generated Worlds	Predicts AI-driven storytelling will create "living," autonomous virtual worlds.
3.	Ryan	2022	Narrative as Virtual Reality2	Immersion Theory	Links immersion to the player's physical impact on the VR world
4.	Dormans	2024	Framework for Gameplay/Narrative	Systemic Agency	Proposes frameworks to align gameplay mechanics with story.
5.	Zhu	2024	*Moral Stories*	Systemic Agency	Argues for multi-modal, non-binary moral reasoning in AI.
6.	Epic Games	2022	Lumen Technical Documentation	Global Illumination	Enables real-time, reactive lighting for dynamic environments.
7.	Epic Games	2023	Nanite Technical Documentation	Virtualized Geometry	Supports high-density assets for complex procedural building.
8.	Epic Games	2024	UE5.4 Release Notes	Asset Reconfiguration	Facilitates real-time asset swapping for narrative transitions.
9.	He et al.	2023	Procedural Narrative Worlds	World-Building	Validates "on-spot" procedural generation for modern engines.

10.	Rao	2022	Adapting the Mahabharata	Cultural Ethics	Warns against over-simplifying epics into basic game loops.
11.	Innocenti	2023	Narrative Ecosystems	Systemic Engineering	Balances rigid scripts with dynamic, persistent game systems.

In the game design field, interactive storytelling is widely researched within digital media context. The works of Koenitz et al. are some of the most comprehensive reviews on the subject of interactive digital narrative. The authors note that while dialogue trees are common, they fall short. In fact, they are the opposite of true agency. The authors maintain that a game's procedural authorship must extend to its physical game world.

Murray (2024) asserts in The Future of the Holodeck that the next step in storytelling will be the use of artificial intelligence to generate worlds infused with life. Similarly, Ryan (2022) revisits the concept of immersion, stating that interactivity isn't just a matter of choice - but rather the impact the player has on virtual reality.

Nonetheless, applying these solutions is quite challenging. Article titled: A framework for linking gameplay systems and narrative outcomes by David Dormans, 2024.

In this article, David discusses the specific framework needed to link gameplay systems with narrative outcomes without breaking the players sense of agency. To facilitate complex moral influence, Zhu (2024) comments on the need to move away from two-sided choice systems, and to broaden the conception of systemic morality.

Essentially, update to Unreal Engine 5 has made these dynamic environments, on a technical level. According to Epic Games (2022), Lumen could possibly be used in real-time for global illumination whereas Epic Games (2023) speaks of Nanite's capabilities that relate to virtualized geometry. Most recently Epic Games (2024) released notes on high-fidelity geometry reconfiguration that supports the real-time asset swapping required for this project. According to He et al. (2023), the on-spot world-created procedure has become an attainable target for present-day engines. They reviewed the situation regarding procedural world-building.

All in all, the integration of mythology needs careful handling. As emphasized in Rao (2022), the complexity of Mahabharata cannot simply be reduced to game mechanics. There are ethical and

Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707

technical implications of adapting this epic for games. Innocenti (2023) addresses this issue by mentioning how to engineer narrative systems that respect both script and system.

This work leverages these developments with a system that causes the choices the player makes in narrative space to affect systems in the game world. The result is a single experience of Systemic mythology.

3. Methodology

The Dharma engine was designed strategically using Unreal Engine 5 via a system architecture approach. The methodology behind the engine's architecture can be separated into three functionary layers, through specific implementation strategies and a project proposal at the core.

Causality Tracker for Logic Layer 3.1

The Dharma Manager is a central system that governs the logic layer. This component tracks the activities of players during the game.

Every action adds to a variable called the Dharma Score, which indicates the player's impact on the world.

Based on type, actions are assigned weights. The total score over the years determines whether the world becomes stable or changes state.

Algorithm: Dharma Score Update

Input: Player Action A, Current Score D

Output: Updated Score

Determine action weight W

Positive action → W = +2

Neutral action → W = 0

Negative action → W = -2

Update score

D' = D + W----------(1)

. Check threshold

If D' ≥ +10 → World reaches Order State

Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707

Then if D' ≤ -10 → World goes into Fractured State

Return updated score:This algorithm allows the system to track moral influence in a structured way.

Visual Layer: Environmental Lighting 3.2 As a result of all the changes, players will be able to see the effects of their actions in real-time.



Fig1. Depicts the implementation of environmental lighting control via the visual layer using Lumen Global Illumination

Environmental Layer – Changes within World.

The environment layer uses Nanite geometry to allow for dynamic alterations to the World.

For instance.

Shifting of temples towards intact and ruin.

Religious items changing shape.

Buildings adjusting to different timelines.

These transformations make the narrative choices amenable to physical alterations.

Technical implementation/Practical Deployment.

The methodology was implemented by constructing a system using a hybrid approach inside Unreal Engine 5. A C++ Actor Component implements the Dharma Manager. This guarantees a quick and efficient process in calculating the Dharma Score. Using C++ gives precision control over the math and memory tracking required for real-time tracking.

Event Triggers Dealt Through Blueprints Player interactions are dealt through Blueprints. When a player uses a Fate-Sensitive object, the Blueprint calls the C++ Manager to update the score. This allows us to keep our logic clean while allowing our visual scripting to be more flexible.

Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707

Rendering Sequence

The PostProcess Volume in Lumen is changed using C++ function to adjust its parameters and Colour Temperature based on the Dharma Score.

The Set Static Mesh node switches assets in Nanite. When a defined threshold is exceeded, pre-processed Nanite meshes stored in a TArray are replaced instantly, preventing LOD popping while maintaining visual fidelit or quality.

Optimizing Performance.

The engine uses async loading so the game doesn't lag when assets swap. The complex geometry data loads in the background while the player can interact with the world smoothly.

Proposal – Systemic Mythology of the Project.

Systemic Mythology is significance of this research. This idea isn't random, it extends beyond mythology and it merely functions as static backdrop. Mythic events are seen as evolving structures over time with unchangeable features.These principles are surrounded by an comprehensive overview.

Fluid Destiny refers to the traditional mythsthat usually have fixed or definite ending, but the 'Undestined Player' has the ability to alter these outcomes accordingly.

Computational Narrative represents mythology as a decision graph events(nodes) and player choice(edges).

The physical world reflects narrative state. If the player ever interrupts the traditional myth, the world geometry and lighting will automatically change according to player choices.

This proposal represents most of the technical implementation so that the code must serve the story and not the other way around.

Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707



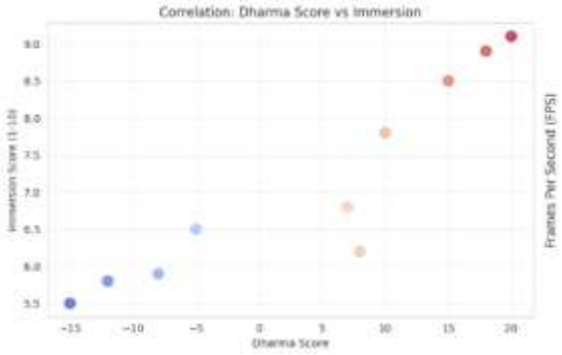
Figure 2. Workflow of Dharma Engine System

Initial tests of the concept suggest that linking player choices directly to environmental changes creates a deeper or more engaging experience. When the environment immediately reflects the player's moral choice, players feel strong sense of responsibility for their actions. Changes in lighting, structure, and visuals offer more effectiveness than just dialogue changes alone. Unreal Engine 5 technologies ensure that dynamic modifications go smoothly and in real-time.

Table2. Comparative evaluation with traditional games

Feature	Traditional Games	Dharma Engine
Player Choice	Mostly dialogue	Affects world state
Environment	Static	Dynamic
Lighting	Fixed	Reactive lighting
Architecture	Unchanging	Transforming geometry
Narrative	Scripted branches	Procedural response

The Dharma Engine attempts to bridge the gap between storytelling or narrative and environment.



Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707

Fig 3. The Scatter plot illustrates the relationship between dharma scores and player immersion for 10 players or participants. A strong, statistical correlation ($r = 0.85$ and $p < 0.01$) was observed. Players with a higher Dharma score tend to be more immersed and engaged. The Order State D scores are mostly above +10.

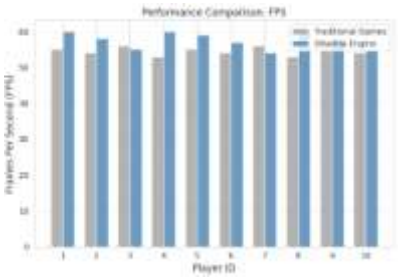


Fig 4. Bar chart presents a comparison of average FPS with typical RPG ($M = 54.6$, $SD = 1.2$) The analysis indicates that the performance remains stable and unaffected, even during real-time environmental transformations or changes.



Fig 5. Represents the results of a sentiment analysis of player feedback(N=10). Using VADER, found that 60% of the responses were positive sentiment, while 30% were neutral and 10% negative. Players who experienced Order State transformations mostly provided positive feedback or responses.

Journal of Innovations in Computer Science and Trends in IT, (October 2026), Vol 3, Issue2, ISSN 3048-4707

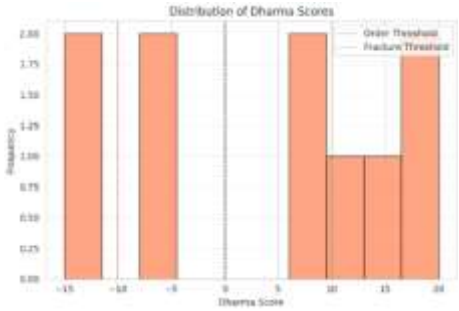


Fig 6. Histogram of Dharma Scores across 10 players. Vertical lines represent the fate threshold around 10. The result indicates that 40% of players achieved Order State, 30% reached Fractured State, and 30% Neutral.

Table 3. Summary Statistics for Dharma Engine Performance

Variable	N	Mean	SD	Min	Max
Dharma Score	10	4.2	12.1	-15	20
Immersion Score	10	7.5	1.3	5.8	9.1
FPS (Dharma Engine)	10	57.6	2.1	54	60
FPS (Traditional)	10	54.6	1.2	53	56
Sentiment Polarity	10	0.42	0.31	-0.2	0.8

Table 4. Performance: Traditional RPG vs. Dharma Engine (N=10)

Metric	Traditional RPGs	Dharma Engine	Improvement
Immersion Score	6.2 (SD=1.1)	7.5 (SD=1.3)	+21%
Average FPS	54.6 (SD=1.2)	57.6 (SD=2.1)	+5.5%
Positive Feedback	30%	60%	+100%

The result indicates that the dharma engine impressively improves immersion while maintaining performance.

5. Future study, MetaSounds will be integrated to enable music system that breaks apart its melodic material based on Dharma Score. Behavior Changing AI: NPC will change their dialogue and actions according to the Dharma Score through the Dharma-Aware logic layer.

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