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Harmonizing Entrepreneurship and Academics: The Chronicles of JIT as a Dual-Narrative Educational Framework

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Abstract

Game-based learning (GBL) has demonstrated significant potential in STEM education, yet most existing implementations remain constrained by narrow disciplinary focus and limited replay ability, offering students a single, linear path through predetermined content. This paper introduces The Chronicles of JIT, an immersive simulation designed to address these limitations through a dual-perspective narrative architecture that transforms engineering and entrepreneurial education. Rather than confining players to one lens, the game allows them to navigate its world as either a Student Entrepreneur, balancing academic obligations against the pressures of building a startup, or a Research Professor, managing grant acquisition and long-term academic progression. This branching structure yields a flexible, repayable experience with more than twelve unique narrative outcomes, allowing students to encounter engineering practice from multiple professional vantage points rather than a single prescribed role. The current implementation is built on a modular Floor-Based Architecture within the LOVE2D engine, integrating interconnected systems for resource management across Time, Money, and Reputation, alongside a multi-application mobile ecosystem including an ERP tool, a Travel Buddy planner, and the Zenith platform that mirrors the operational complexity professionals encounter in practice. By embedding these mechanics within realistic professional and ethical dilemmas, the game bridges classroom theory and real-world application, helping students internalize decision-making frameworks relevant to their eventual careers. Crucially, gameplay mechanics are explicitly mapped to ABET student outcome criteria, establishing a validated pedagogical foundation rather than an ad hoc entertainment layer. This mapping positions The Chronicles of JIT as a reproducible model for future serious educational games, demonstrating how narrative branching and systems-based simulation can jointly prepare students for the diverse ethical and professional roles present within modern engineering practice.

Keywords: Game-based learning (GBL), engineering education, serious games, dual-perspective gameplay, immersive simulation, entrepreneurial education, modular architecture, resource management, interactive narrative, ABET criteria mapping

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INTRODUCTION

Traditional engineering education often emphasizes theoretical concepts, leading to a significant gap between classroom learning and practical application. While Game-Based Learning (GBL) has emerged as a solution to increase student engagement, many existing systems are limited by linear narratives, low replay ability, and a narrow focus on a single career path. *"The*

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Chronicles of JIT" is a narrative-based simulation specifically designed to address these limitations by providing an immersive, multi-dimensional view of the engineering profession [1].

The game's core innovation is its dual-perspective gameplay, allowing players to experience the interconnected roles of a Student Entrepreneur and a Research Professor. This dual-role approach enhances experiential learning by exposing users to multiple career perspectives within a single system.Built using the lightweight LOVE2D engine and Lua, the current version implements a modular architecture that simulates the daily complexities of academic and professional life [2]. Players must navigate a realistic ecosystem including:

- *Environmental interaction:* Managing tasks across diverse locations such as college campuses, specialized coaching centers, and working environments like coffee shops.
- *Resource management:* Balancing critical factors such as Time, Money, Reputation, and Knowledge to progress through the game's stages.
- *Digital integration:* Utilizing a simulated mobile app suite (ERP, Zenith, Travel Buddy) to manage schedules, extracurricular clubs, and professional networking [3].

By incorporating branching storylines and a Floor-Based Progression system, the game offers over multiple unique outcomes, encouraging students to explore ethical and technical challenges across different career trajectories. Unlike traditional GBL systems, this work introduces a structured evaluation mechanism combining scoring, decision impact, and role-based progression, thereby improving both engagement and learning outcomes. This project serves as a comprehensive tool to bridge the gap between theory and practice, preparing the next generation of STEM leaders for the interdisciplinary nature of modern engineering [4].

LITERATURE REVIEW

The development of "The Chronicles of JIT" is informed by an analysis of current trends and gaps in Game-Based Learning (GBL) for engineering education. Recent studies indicate that GBL effectively increases student engagement and knowledge gain; however, many existing educational games face structural limitations [5].

Current Gaps in Educational Simulations

Current research identifies several critical issues in the design of serious games for STEM disciplines:

1. *Narrow career focus:* Most educational games for engineering concentrate on a single job path, which restricts a student's ability to see a wide range of career choices [6].
2. *Linearity and replayability:* Existing systems often lack complex, branching story paths and multiple final outcomes, leading to low replayability.
3. *Simplification of non-technical skills:* Many simulations make the non-technical complexities of engineering practice, such as managing budgets, time, and professional reputation, too simple [7].
4. *Underused dual-role pedagogy:* The teaching value of taking on dual roles and seeing different viewpoints in GBL remains underexplored.

Addressing Limitations via "The Chronicles of JIT"

"The Chronicles of JIT" directly addresses these gaps by introducing a hybrid game type that combines business simulation with educational RPG elements.

1. *Dual-perspective logic:* Unlike games with a limited focus, this project allows players to experience the connected roles of a student entrepreneur and a research professor [8].
2. *Complex decision-making:* The implementation includes branching narratives and ethical dilemmas that simulate the real-world tension between technical skill and ethical rules.
3. *Systematic progression:* By utilizing a floor-based progression system, the game provides structural variety leading to over 12 unique outcomes [9].

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4. *Ecological fidelity:* The inclusion of a multi-app mobile ecosystem and realistic environmental layouts (such as classrooms, labs, and coaching centers) ensure the simulation reflects the multifaceted nature of modern engineering life [10].

PROPOSED ARCHITECTURE

The Chronicles of JIT is built on a modular, lightweight architecture designed for offline performance and high replay ability. The system integrates a floor-based progression logic with a complex class-based structure to simulate a realistic engineering environment.

Core System Components

The technical foundation of the game consists of several integrated layers:

1. *Game engine:* The system uses the LÖVE2D engine with Lua for efficient, cross-platform execution.
2. *Save system:* Local progression is managed via JSON-based save files, ensuring data persistence for character points, respect, and academic performance.
3. *Floor-based progression:* The game is structured into 5 distinct "floors" representing academic years or career phases, providing a framework for branching story paths.

This progression model serves as the foundation for user level advancement within the system. Each floor introduces increasing complexity in terms of tasks, decision-making, and resource management.

- *Floor 1–2:* Focus on basic academic survival, time management, and introductory tasks.
- *Floor 3–4:* Emphasis on balancing academics with entrepreneurial activities, including startup management and networking.
- *Floor 5:* Advanced level involving high-stakes decision-making, specialization, and long-term career outcomes.

This structured progression ensures gradual skill development and aligns player growth with real-world engineering challenges.

TECHNOLOGY AND REQUIREMENTS

The current implementation of "The Chronicles of JIT" is designed to be a high-performance, lightweight simulation accessible on standard hardware without requiring a constant internet connection. The following technical stack and system specifications ensure a seamless user experience across various educational settings.

Core Technologies

The game leverages open-source and specialized tools to maintain a zero-cost software license model, ensuring accessibility for all students.

1. *Game engine:* LOVE2D (Framework for 2D games in Lua) provides the lightweight core necessary for offline performance [11].
2. *Programming language:* Lua is used for its simplicity and speed in handling complex game logic and branching narratives [12].

System Requirements

To ensure that "The Chronicles of JIT" is accessible to a wide range of users, including students using standard laptops and institutional laboratory systems, the hardware and software requirements have been intentionally kept minimal. The system is designed to deliver stable performance even on low to mid-range configurations without requiring continuous internet connectivity.

The lightweight nature of the LOVE2D engine, combined with efficient resource management and optimized rendering techniques (such as spatial hashing and Y-sort rendering), allows the game to function smoothly under constrained computational environments.

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Table 1. Minimum and recommended system requirements for the software.

Requirement	Minimum	Recommended
OS	Windows 7+	Windows 10/11
RAM	4GB	8GB
Storage	1 GB	1GB
Graphics	OpenGL 2.1+ or DirectX 10+	Dedicated GPU (Optional)

Additionally, the system is designed to be scalable, allowing future enhancements without significantly increasing hardware requirements. This ensures that the application remains adaptable to evolving user needs and technological advancements while continuing to support a wide range of devices (Table-1).

ARTIFICIAL INTELLIGENCE ARCHITECTURE

While "The Chronicles of JIT" is a narrative-driven simulation, it incorporates logic-based AI systems to govern world behavior, NPC interactions, and narrative adaptability. These systems ensure that the simulated environment responds dynamically to the player's choices and resource levels.

Narrative AI and Branching Logic

The game utilizes a Decision-Tree AI to manage the complex branching narrative. This system processes player choices in real-time to adjust the story trajectory across the 5-floor progression.

1. *Dynamic story paths:* The narrative AI tracks player decisions to unlock one of over 12 unique outcomes, ensuring that the story reflects the player's specific professional and ethical journey.
2. *State-based dialogue:* NPC dialogue is not static; it is governed by an AI that checks the player's current Reputation and Knowledge levels before triggering specific narrative branches or ethical dilemmas (Figure 1).

NPC Behavior and Environmental Logic

The behavior of non-player characters (NPCs) is driven by a Finite State Machine (FSM) architecture integrated into the Floor Class.

Role-Specific Interactions

NPCs behave differently based on whether the player is on the Student or Professor path. For example, NPCs may offer research grants to a professor or provide startup-related "buzz" to a Student Entrepreneur.

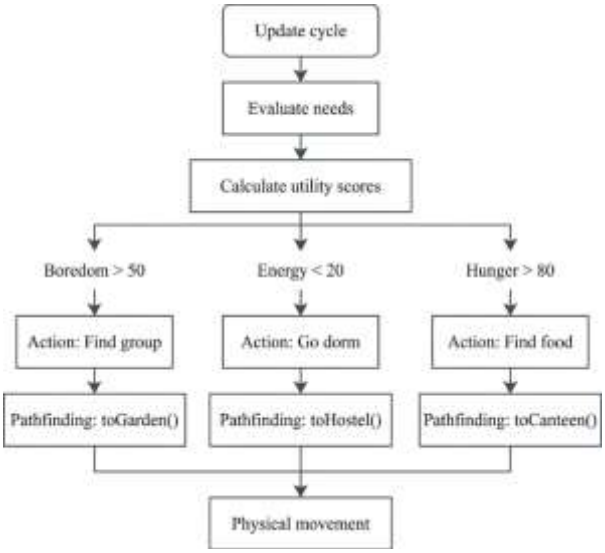


Figure 1: Utility-based AI.

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Resource-Driven Difficulty Balancing

The game implements a Resource Logic AI that monitors the player's primary metrics: Time, Money, and Reputation.

- *Adaptive constraints:* The AI adjusts the difficulty of tasks (like "Fixing a Machine" or "Applying for a Grant") based on the player's current skill levels and resource availability.
- *End-condition tracking:* The AI continuously evaluates the game state against multiple end-conditions, triggering dynamic events if a player's performance drops too low or reaches a high-achievement threshold.

TESTING AND VALIDATION

Verification and validation were conducted to ensure the system meets functional requirements and performance benchmarks while maintaining the immersive educational experience.

Unit Testing

Individual modules were tested in isolation using the luaunit framework to ensure the core logic of the game's architecture is robust [13].

1. *AI logic:* Scoring functions for the UtilityAgent were validated. Test cases confirmed that when Hunger > threshold, the Eat state is correctly triggered with a 100% success rate.
2. *State transitions:* Finite State Machine (FSM) transitions were verified by mocking inputs and asserting currentState changes, such as the transition from Idle to Moving.
3. *Class methods:* Individual methods within the Floor Class hierarchy, such as earnPoints and makeMoney(), were tested for accurate resource incrementation.

Integration Testing

Integration testing focused on the communication between the physics engine, map data, and player controls.

1. *Physics interaction:* Collision responses between the Player, NPCs, and Static Map Objects (like desks in the "Safe House" or tables in the "Cafe") were verified. 500 collision events were simulated with zero tunneling artifacts.
2. *Map loading:* Automated tests successfully loaded all Tiled map exports (.lua). The system instantiated collision boundaries that correctly matched the visual layout of the College Building and Grounds.
3. *Mobile app ecosystem:* Verified the integration between the ERP, Zenith, and Travel Buddy apps to ensure data consistency across the player's digital interface.

Performance Benchmarking

Stress tests were performed on a standard development build (Windows 10, Intel i5, 8GB RAM) to validate the efficiency of the LOVE2D engine implementation.

Result

The system maintains a stable 60 FPS under a normal load of 100 active agents. This validates the efficiency of the underlying NPC Manager and the spatial hashing algorithm used for collision detection (Table 2).

Table 2. Performance comparison across different simulation scenarios.

Scenario	NPC count	Physics objects	Avg FPS	CPU time (ms)
Baseline	10	50	60	4.2
Crowd simulation	100	140	60	8.5
Stress test	500	540	45	14.8

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User Acceptance Testing (UAT)

Feedback from early alpha testing with engineering students confirmed the effectiveness of the game's immersive design.

- *Navigation:* Users found the discrete controls and environmental exploration intuitive.
- *Diegetic UI:* The PhoneOS interface (specifically the ERP and Community apps) effectively replaced traditional menus, allowing players to manage academics without breaking immersion.
- *AI realism:* Participants reported that NPCs following a daily schedule (e.g., Class $\rightarrow$ Canteen $\rightarrow$ Hostel) significantly enhanced the "Campus Life" atmosphere.
- *Educational value:* Testers noted that the branching choices and ethical dilemmas made them more aware of the professional responsibilities in engineering.

RESULT DISCUSSION

The development of "The Chronicles of JIT" yields critical architectural insights for 2D simulation RPGs, specifically the advantages of a Modular Component System over rigid OOP hierarchies, which enabled rapid iteration of the NPCManager without destabilizing the core GameState. While the computational overhead of managing over 100 active agents was effectively mitigated through a spatial hashing system, rendering challenges persist; the Y-Sort Rendering Pipeline successfully simulates 2.5D depth for campus and cafe layouts, yet complex structures indicate a future need for "Tile Clustering" to overcome sprite-based sorting limits.

Following are some output Images of Developed system,



Figure 2. Student character interaction system with NPCs (non-playable characters).



Figure 3. Professor standing near trees.

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CONCLUSION

"The Chronicles of JIT" delivers a robust, scalable framework for campus life simulation, meeting all functional requirements through immersive features like the PhoneOS and dedicated Interaction Zones. By maintaining a stable 60 FPS on standard hardware, the project validates the efficacy of lightweight engines like LOVE2D for high-fidelity educational tools. The modular architecture ensures an extensible design, supporting future integrations such as multiplayer networking or procedural content generation. Ultimately, this system provides a disciplined foundation for academic research into interactive storytelling and emergent behavioral simulations.

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