



MSc Thesis:

Leveraging Large Language Models for Dynamic NPC
Interactions in 2D RPGs

By
Topalidis Iason

Supervising Professor:

Minas Dasygenis,
Associate Professor

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Introduction

The Problem

- Limited Dynamism in Game Content.
- Player Experience Limitations.
- Technical Challenges

The Solution

- ✓ Large Language Models for Game Content
- ✓ Client-Server Architecture
- ✓ Structured Generation with Validation

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Technical Design

Technical Design Principles and Technologies

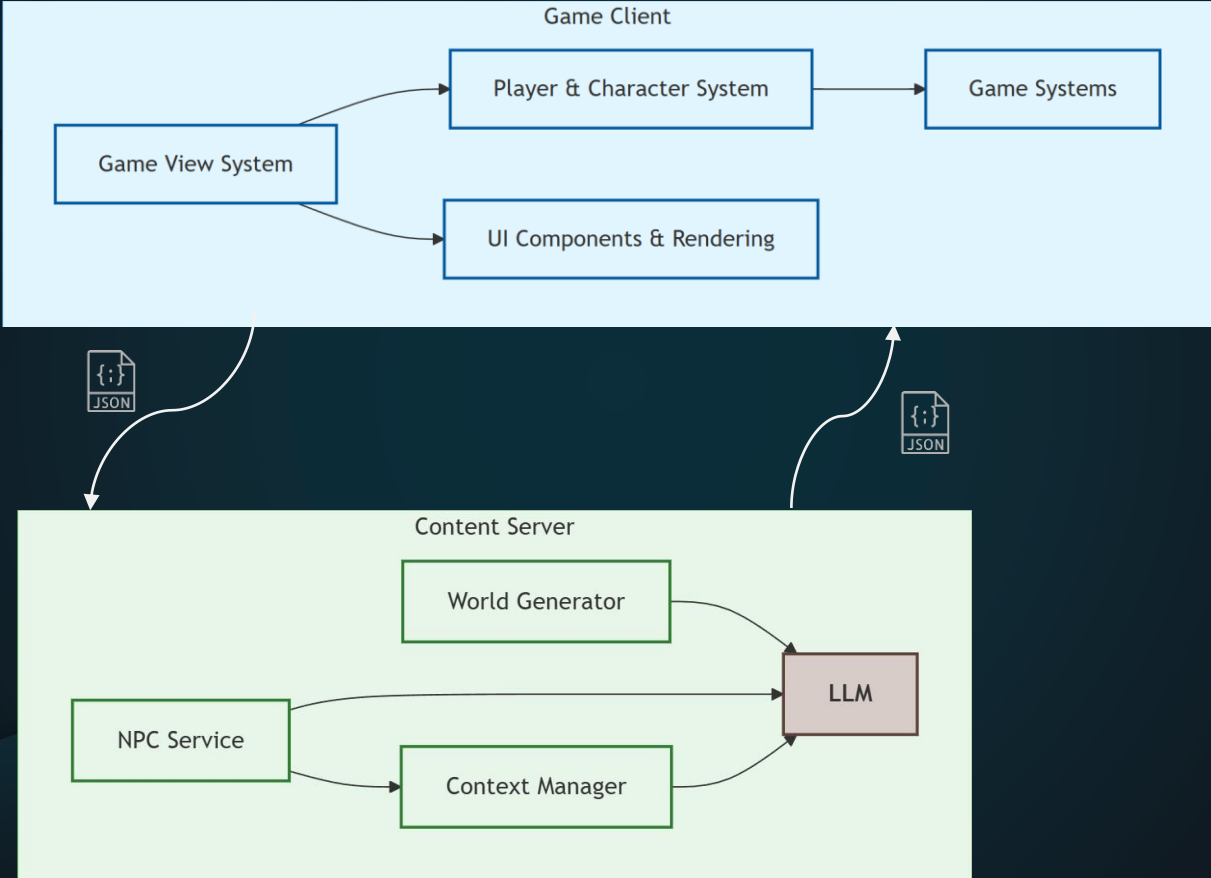
1) Modular Components.

Separation of concerns
Client-server design
Asynchronous processing

2) Technologies

Game Client: Arcade Python library for graphics and UI
Content Server: FastAPI backend with LLM integration
Model: Integration with Qwen2 7B LLM through Ollama

System Design

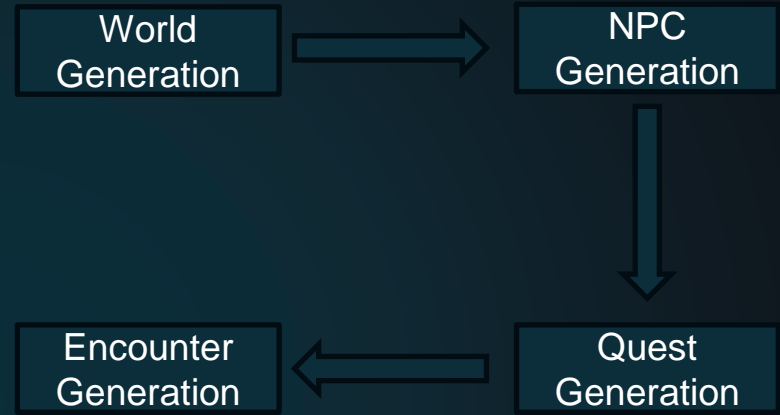


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Content Generation Systems

Content Generation Pipeline Overview

- Multi-Stage Generation Process
- Generation Flow



Key principles:

Coherence across generated elements

Schema-driven validation at each stage

Contextual relationships between components

World Structure Generation



NPC Generation System



Quest Generation System



Encounter Generation System



Dialogue System

- Dynamic Dialogue System
- Conversation Summarization

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Gameplay Systems

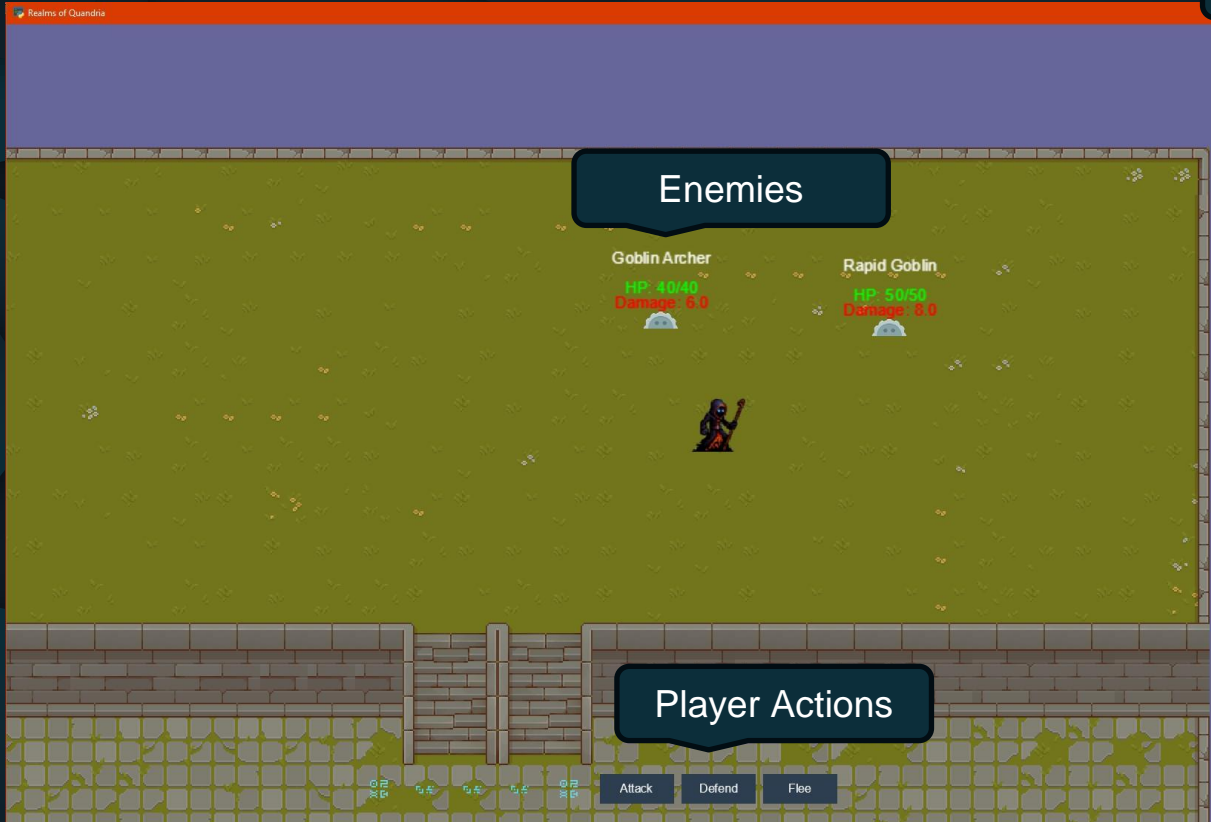
Gameplay Loop (1/5)



Gameplay Loop (2/5)

Turn indicator

Turn: player_turn



Player Stats
Health: 500/500
Damage: 80
Defense: 10
Level: 1
EXP: 0/204 to next level

Gameplay Loop (3/5)

The screenshot shows an inventory interface for the game 'Realms of Quandria'. The window title is 'Realms of Quandria'. The interface is divided into three main sections: 'Items & Description', 'Inventory', and 'Stats & Equipment'.
1. 'Items & Description': A tooltip for 'Leather Armor' is displayed. It lists: Type: Armor, Defense: 3, Value: 40 gold, and Value: \$40. Below the tooltip, a small grid shows the armor icon and a sword icon.
2. 'Inventory': A large grid of 24 slots is shown. The first two slots are occupied by a sword and a shield. The text 'Slots used: 4/24' is displayed at the bottom of the grid.
3. 'Stats & Equipment': A blue panel showing character statistics and equipped items.
- Character Stats: Health: 500/500, Damage: 95, Defense: 10, Gold: 100.
- Equipped Items: Chest: None, Main Hand: Steel Sword.
At the bottom center, there is a red button labeled 'Return to Game'.

Gameplay Loop (4/5)

The screenshot shows a game window titled "Realms of Quandria". The main area is a green field with a stone path. A character named "Suna Sunflower Mage" is on the left. A "Quest Board" is on the right. A character named "Eldric of Shadow" is at the bottom right. A "Player Stats" box is in the bottom right corner.

Player: what can you tell me about the valley?
Suna Sunflower Mage: The Valley of Sunflowers, a realm where arcane knowledge weaves through nature's tapestry, is a sacred ground for those who seek to unlock the heart of wisdom. Its golden fields are not just landscapes but living lessons, whispering secrets to those who listen with intent hearts. Ancient tomes and mystical structures here act as guides, leading explorers along paths of enlightenment that stretch beyond imagination.

Yet beware, for the valley harbors dangers as well—those who delve too deeply into its mysteries might become lost in its arcane depths. Let your spirit be your guide, embracing a connection with nature rather than trying to conquer it. The true wisdom lies in aligning your path with the rhythms of life, for in doing so, you'll uncover truths greater than any written word could express.

Embrace this journey into the heart of the valley; let it unfold secrets that transcend the boundaries of mortal understanding.

Submit

Player Stats
Health: 500/500
Damage: 95
Defense: 10
Level: 1
EXP: 0/204 to next level

Gameplay Loop (5/5)

The screenshot shows a quest interface for "Goblin Ambush at the Tower" in the game "Realms of Quandia". The quest description is "Seek vengeance for the attacks on the guardians at Shadowcliff Tower." The progress bar is at 0%. The quest rewards include 150.0 Experience and 65.0 Gold. The reward items are Ironclad Battleaxe (Weapon, Damage: 25.0), Armored Shield (Armor, Protection: 10.0), and Goblin Treasure (Value: 70.0 gold). The quest steps are: Step 1: In Progress, Go to Tower of Shadowcliff; Step 2: In Progress, Talk to Eldric of Shadowcliff; Step 3: In Progress, Engage with the Goblin Ambush. A manual completion warning states that using "Complete Step (If Stuck)" will not grant any rewards. At the bottom, there are buttons for "Back to Quest List" and "Return to Game".

Realms of Quandia

Goblin Ambush at the Tower

Seek vengeance for the attacks on the guardians at Shadowcliff Tower.

Quest Progress: 0%

Locations: Tower of Shadowcliff NPCs: Eldric of Shadowcliff

Experience: 150.0 Gold: 65.0

Quest Rewards:

Reward Items:

- **Ironclad Battleaxe (Weapon, Damage: 25.0)**
A sharp tool for chopping through enemy lines.
- **Armored Shield (Armor, Protection: 10.0)**
An enchanted shield that protects the bearer from foes' blows.
- **Goblin Treasure (Value: 70.0 gold)**
A hoard of coins and gems collected by goblins.

Quest Steps:

Step 1: • In Progress
Go to Tower of Shadowcliff

Complete Step (If Stuck)

Step 2: • In Progress
Talk to Eldric of Shadowcliff

Complete Step (If Stuck)

Step 3: • In Progress
Engage with the Goblin Ambush

Complete Step (If Stuck)

MANUAL COMPLETION WARNING
Using 'Complete Step (If Stuck)' will not grant any rewards

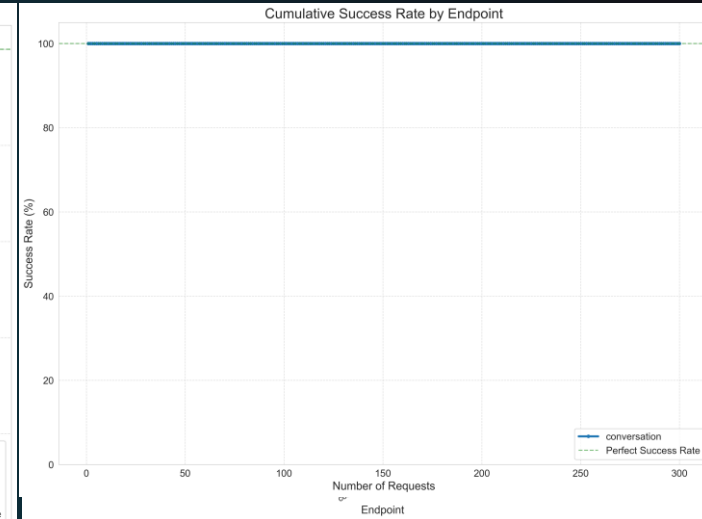
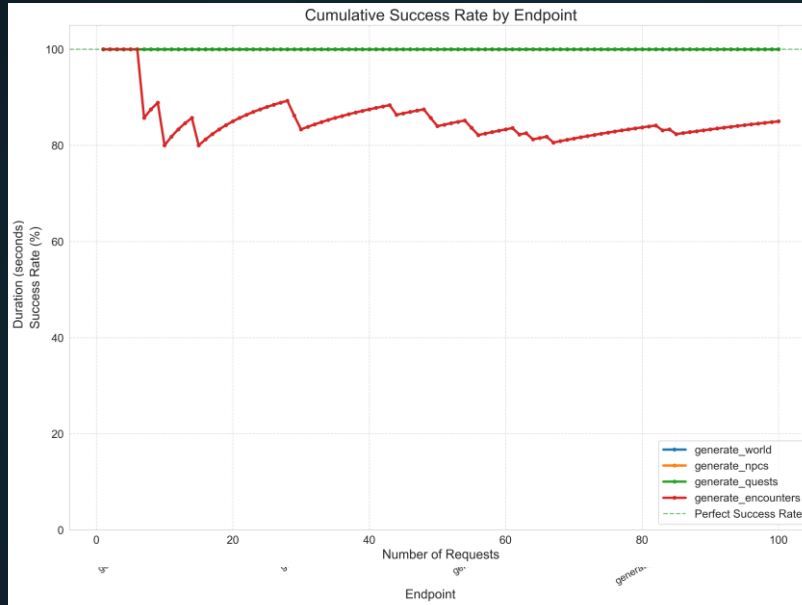
[Back to Quest List](#) [Return to Game](#)

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Evaluation, Results & Future Work

System Performance & Reliability

- Response Times
- Success Rates



Implications & Future Directions

Game Development Implications

Future Research Opportunities

Cross-Genre Applications

- Relevant to optimize the user experience in game development
- Ability to generate content beyond text to enhance player experience
- Ability to generate realistic NPC behavior & relationships
- Relationships & generation of adaptive, personalized learning scenarios

Demo

Realms of Quandria

Click anywhere to continue



Acknowledgements



Contact Information

ias.topalidis@gmail.com