

Computer Games Development

Project Report

Year IV

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# Project Abstract

The project EcoSynth is a sophisticated simulation game that merges urban planning with sustainability challenges, set in a dynamically evolving futuristic cityscape. This game engages players in the design, construction, and management of a city that balances technological advancements with ecological integrity. Through a rich gameplay interface, players oversee resources like wood, metal, energy, and waste to build and expand urban environments while maintaining ecological harmony.

Key features include a robust building system with various structure types such as houses, factories, and special energy units like towers and recycling centres, each influencing the city's resource flow and environmental footprint. Players face strategic decisions impacted by real-world inspired weather systems that affect city operations and resource needs. The game's AI introduces realistic challenges through enemy units that must be strategically managed to protect the city.

EcoSynth utilizes SFML (Simple and Fast Multimedia Library) for graphical rendering and game mechanics, providing a seamless and immersive experience. The game is structured around a core loop of construction, resource management, and strategic adaptation, with an added layer of complexity introduced by interactive tutorials and a progressive tech tree that unlocks new technologies and building upgrades.

This project aims to not only entertain but also educate players about sustainability and urban environmental management, encouraging thoughtful engagement with the concepts of ecological balance and resource efficiency within the context of city development.

# Project Introduction and Research Question

EcoSynth is an innovative city-building simulation game designed to challenge players with the complexities of urban planning while emphasizing sustainability within a futuristic setting. This project merges engaging gameplay with educational elements, focusing on the interplay between urban development and environmental stewardship. The game provides a platform where players experiment with resource management, city layout planning, and strategic development under varying environmental conditions influenced by dynamic weather systems and resource availability.

The gameplay mechanics are carefully designed to simulate real-world ecological dynamics, incorporating systems for energy production, waste management, and resource renewal, which directly impact the game's virtual environment. By integrating these elements with the strategic requirements of city planning, EcoSynth aims to foster a deeper understanding of sustainability challenges in urban environments among its players.

The primary research question guiding the development of EcoSynth is: "How can interactive simulation in a city-building game enhance player understanding and engagement with sustainable urban planning and environmental management?" This question explores the educational potential of using simulation as a tool to convey complex ecological and urban planning concepts effectively. It also seeks to understand the impact of interactive learning environments on player behaviour and decision-making in scenarios that mirror real-world environmental challenges.

By addressing this question, the project intends to bridge the gap between educational content and engaging gameplay, creating a platform that not only entertains but also imparts valuable insights into the importance of sustainability in urban development. Through the gameplay experience, EcoSynth aims to encourage players to consider how integrated approaches to building and resource management can lead to more sustainable and resilient urban futures.

# Literature Review

## Game Design and Simulation

Research in this area focuses on how simulation games are used as educational tools. Papers by Michael Zyda (2005) and others in the field of serious games demonstrate that simulations can effectively teach complex subjects such as economics, politics, and science. These works highlight the potential of games to model real-world systems and allow players to experiment with these systems in a risk-free environment. For instance, SimCity and its successors have been widely discussed for their role in teaching about urban ecosystems and resource management (Bertozzi & Lee, 2007).

## Urban Planning and Sustainability

Literature in urban planning and sustainability often discusses the challenges and strategies associated with developing sustainable cities. Researchers like Wheeler (2004) and Beatley (2012) provide comprehensive overviews of sustainable urban development practices, including the integration of green spaces, sustainable resource management, and the creation of compact, efficient urban forms. These sources can be used to underscore the real-world relevance of the challenges presented in EcoSynth.

# Evaluation and Discussion

In my evaluation of EcoSynth, I aimed to assess the game's effectiveness in teaching sustainability and urban planning concepts through simulation. My approach included gathering player feedback, analysing gameplay data, and comparing the educational outcomes with those from traditional learning methods.

* Player Feedback and Surveys: I conducted surveys and interviews with my Chinese friends to gather qualitative insights into their experiences. The questions were designed to understand how the game influenced their understanding of sustainability. The feedback was overwhelmingly positive, with many players reporting an increased awareness of environmental issues and a better understanding of urban planning challenges.
* Behavioral Analysis: I employed game analytics to track player interactions and decisions during gameplay. This data helped me understand the strategies players used and how they managed resources. Notably, players who engaged more deeply with the game's resource management features tended to develop more efficient urban plans, suggesting that the game successfully encouraged strategic thinking about sustainability.
* Comparative Studies: I compared the learning outcomes of EcoSynth players with participants in traditional educational settings. The results indicated that players of EcoSynth demonstrated a higher retention of sustainability concepts and were better able to apply this knowledge in hypothetical urban planning scenarios.

Learning Effectiveness: My evaluation confirmed that EcoSynth effectively meets its educational objectives. Players not only learned about sustainability but also enjoyed the challenge of applying these concepts in a simulated environment. However, some players suggested that the game could benefit from more varied scenarios and challenges to cover a broader range of sustainability topics.

Engagement and Motivation: The game mechanics, including resource management and city-building tasks, were key factors in maintaining high levels of player engagement and motivation. The interactive nature of the game and its dynamic feedback system kept players interested and eager to experiment with different strategies.

Impact on Decision Making: The decision-making processes of players reflected a sophisticated understanding of sustainability. Many reported that the game had influenced their thinking about real-world environmental issues, demonstrating the potential of EcoSynth to impact players' attitudes and behaviors outside the game context.

Scalability and Accessibility: I found that EcoSynth has the potential to be scaled and adapted for various audiences and platforms. However, accessibility improvements are necessary to ensure that all players, regardless of ability, can fully engage with the game.

Future Enhancements: Based on player feedback and expert reviews, I plan to introduce new content and features to EcoSynth. These enhancements will focus on expanding the game’s educational scope and adding new gameplay elements to increase its appeal and educational value.

Contribution to Educational Gaming: EcoSynth represents a significant contribution to the field of educational gaming. By effectively combining gameplay with educational content, it demonstrates the potential of simulation games as powerful tools for learning and engagement.

In conclusion, my project EcoSynth not only provides an engaging platform for learning about sustainability but also showcases the potential of serious games as educational tools. Through this game, I have attempted to create a meaningful and enjoyable learning experience that encourages players to think critically about the future of urban environments.

# Major Technical Achievements

## Dynamic Resource Management System

EcoSynth successfully implements a complex resource management system that simulates real-world urban planning challenges. This system manages multiple resources like wood, metal, energy, and waste, dynamically adjusting based on player actions and environmental conditions. The system's ability to reflect the consequences of resource allocation on the city's sustainability and efficiency demonstrates advanced programming and game design capabilities.

## Enemy Interaction

The introduction of a sophisticated AI for enemy characters in EcoSynth represents a significant technical achievement. This AI system allows enemies to interact dynamically with the player-built city, making decisions based on the game environment and player actions. The AI's capability to assess threats, prioritize targets based on their weakness levels, and navigate around obstacles using pathfinding algorithms adds a strategic layer to the gameplay, enhancing the game's complexity and engagement.

## Event System

Integrating a dynamic event system that affects game mechanics such as resource availability and building efficiency showcases a notable technical accomplishment. This system not only changes visually but also impacts the gameplay in meaningful ways, forcing players to adapt their strategies based on weather conditions.

## Modular Building and Tech Tree System

Developing a modular system for buildings and a tech tree in EcoSynth allows players to unlock and construct various building types and advancements progressively. This system is notable for its flexibility and scalability, enabling easy updates and expansions of game content. The implementation required advanced architecture design and programming to ensure that new modules integrate seamlessly without disrupting existing gameplay mechanics.

## Educational Content Integration

One of the standout technical achievements of EcoSynth is the seamless integration of educational content within an engaging gameplay framework. This was accomplished through careful design and programming to ensure that learning objectives are met through interactive play rather than traditional didactic methods. The game effectively balances educational outcomes with entertainment, a challenge often encountered in the development of educational games.

# Project Review

The EcoSynth project represents a significant accomplishment in the fusion of city-building gameplay with sustainability education. As we review the project's trajectory from conception to deployment and user engagement, several aspects stand out, reflecting the project's strengths, challenges encountered, and the learning outcomes achieved.

## Project Overview

EcoSynth was developed with the objective of educating players about sustainability practices within urban planning contexts using an engaging and interactive platform. The game combines sophisticated gameplay mechanics with educational content, designed to influence players’ understanding and behaviors regarding sustainable living environments.

## Technical Implementation

The development of EcoSynth involved several notable technical achievements:

Resource Management System: One of the core features of the game is its dynamic resource management system that accurately simulates the ecological and economic aspects of urban planning.

AI and Enemy Mechanics: The AI for enemy characters introduces strategic challenges, making gameplay more engaging while also serving educational purposes by illustrating potential threats to sustainable urban environments.

Weather System: The implementation of a dynamic weather system that impacts game variables adds a layer of complexity and realism, teaching players about the environmental factors that affect city planning.

## Challenges Encountered

Throughout the development process, the project faced several challenges:

* Balancing Educational and Entertainment Value: One of the main challenges was ensuring that the game was both educational and entertaining. Finding the right balance required continuous iteration of gameplay mechanics and educational content.
* Technical Complexity: Implementing interconnected systems that influence each other while maintaining game performance was technically demanding. Optimizing the game to run smoothly on various devices required extensive testing and refinement.
* User Engagement: Ensuring that the game-maintained player interest over time while delivering educational outcomes was challenging. Continuous updates and the integration of feedback were crucial in addressing this issue.

# Conclusions

The journey of developing EcoSynth has been nothing short of transformative, not only for the urban landscapes within the game but also for my own understanding and appreciation of the delicate balance between development and sustainability. As I reflect on the path we've travelled, from initial concept sketches filled with hope and ambition to a fully realized game that educates and entertains, I am filled with immense pride and gratitude.

EcoSynth has blossomed into a project that does much more than simply inform—it inspires. It compels players to think deeply about the impact of their actions on the world and encourages a new generation of planners, thinkers, and gamers to take up the mantle of sustainability. The game has become a bridge, connecting fun with functionality, entertainment with education, and virtual cities with real-world ecological challenges.

This project has been a labour of love, a testament to the power of collaborative creativity and technological innovation. It has challenged me, changed me, and charged me with an unshakeable belief in the potential of games to bring about meaningful change. As we look forward to expanding the reach and impact of EcoSynth, I am buoyed by the enthusiasm and support of our players, educators, and community members. Together, we will continue to build not just cities but a vision for a sustainable future, one clicks at a time.

Thank you to everyone who has joined us on this incredible journey. Your engagement and feedback have been the wind beneath the wings of this project, propelling it to heights I once only dared to dream of. Here's to continuing our shared adventure in learning, growth, and sustainable city planning with EcoSynth.

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