## Senior Design Project Essay – Nathan Nguyen

Our senior design project centers on developing a 2D detective-style video game that uses artificial intelligence to create dynamic, natural conversations with non-player characters. What excites me most about this project is how it brings together multiple computer science domains I've studied: artificial intelligence, human-computer interaction, systems design, and cloud computing. Instead of relying on scripted dialogue trees, we're building a game where players can actually interrogate AI-powered characters using natural language to solve mysteries. This represents a genuine fusion of academic theory with real-world systems engineering, creating something that could genuinely change how players experience interactive storytelling.

My coursework at the University of Cincinnati has laid a solid foundation for tackling this ambitious project. CS2028 Data Structures and CS3021 Software Engineering taught me how to design efficient data structures and build maintainable, well-architected systems. These skills will be crucial for both our gameplay engine and backend architecture. CS4028 Artificial Intelligence introduced me to classical reasoning and search methods, while CS5173 Deep Learning gave me hands-on experience with neural networks. Both courses directly connect to how we'll design and implement our AI-driven NPCs. CS5167 UI/UX Design was particularly valuable because it taught me user-centered design principles, usability testing, and interface evaluation. These courses didn't just provide technical tools. They taught me how to evaluate tradeoffs, document complex systems, and collaborate effectively in structured development environments, which are essential skills for any successful team project.

My co-op experiences have been equally important in preparing me for this project. At Capital One as a Software Engineering Intern this past summer, I engineered a full-stack platform to track billions of dollars in payments using Python, Flask, GraphQL, and AWS. When I optimized backend performance with Redis caching on AWS ElastiCache, I learned firsthand how to design cloud systems that are both scalable and efficient. These skills will translate directly to our AWS-backed inference system for NPC dialogue. During my spring internship at 84.51° as a Machine Learning Engineering Intern, I designed reusable BERT embedding pipelines and built an end-to-end agentic AI system with Microsoft AutoGen. This experience strengthened my ability to create intelligent systems that can interact autonomously with data. My earlier internships at 84.51° in summer and fall 2024 involved working on microservice architectures with Angular.js and Spring Boot, refactoring backend systems, optimizing databases with Terraform, and building pipeline monitoring tools in Azure. Beyond the technical skills, these experiences taught me how to work effectively in agile teams, manage competing priorities, and communicate complex technical ideas clearly.

What truly motivates me about this project is how it combines my passion for artificial intelligence with my longtime love of interactive storytelling and games. The possibility of creating NPCs that can engage in truly dynamic, AI-driven conversations rather than following predetermined scripts is genuinely thrilling. This represents more than just a technical challenge; it's an opportunity to demonstrate how cutting-edge technology can make games more immersive and infinitely more replayable. I'm especially excited by the chance to showcase how cloud systems and LLM-powered agents can be seamlessly integrated into creative applications. This project bridges the gap between academic concepts and industry-grade tools in a way that feels both meaningful and fun.

Our preliminary approach divides the work into two distinct phases: systems design and planning during the first semester, followed by implementation and integration in the second. We'll start by solidifying our narrative structure, defining our technical architecture in detail, and setting up the AWS backend for inference. The implementation phase will focus on developing the 2D game environment, integrating natural language NPC interactions, and ensuring smooth communication between frontend and backend systems. By project completion, we expect to deliver a fully playable game that demonstrates novel applications of AI in interactive media. I'll evaluate my contributions based on several key criteria: whether I deliver a reliable, efficient backend that supports responsive gameplay, whether my teammates find my work easy to integrate with their components, and whether our final product meets our established usability and functionality goals. Success won't just be measured by producing a complete game, but by creating an experience that truly demonstrates the real potential of AI-enhanced storytelling in interactive media.