Raihaan Sandhu

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Education

University of Toronto **Expected Graduation: May 2028**

Bachelor of Computer Science (Focus in Game Design) *3.98/4.00 GPA*

Relevant Coursework: Systems Programming, Object-Oriented Programming, Computer Organization, Data Structures

Extracurricular Activities: Member of UofT Game Design and Development Club

Experience

Software Engineer Intern (C/C++ Compilers) May 2026 – Dec 2026

IBM *Toronto, ON*

- Implemented the first successful build of the SPEC CPU 2026 suite on z/OS using IBM's LLVM C/C++ compiler, diagnosing and fixing **200+ compilation failures across 23 benchmarks**
- Built a Python diagnostic tool pairing a custom RAG server over IBM's internal documentation with an LLM to match build failures to root causes and recommend targeted fixes, **cutting internal per-benchmark porting time by 60%**
- Delivered a **3x runtime speedup** on FP-heavy workloads by identifying software-emulated floating-point operations and configuring LLVM to emit hardware floating-point instructions
- Ported custom headers and functions for **12 C/C++ libraries**, implementing POSIX interfaces missing from z/OS
- Deployed an external LLVM buildbot on z/OS, automating compiler regression testing across **10,000+ test cases**

Game Development Projects

Baggage (Ubisoft Toronto NEXT 2nd Place) | *C++, Ubisoft API* GitHub

- Built a **custom 3D game engine** in C++ from scratch with an Entity-Component-System architecture, scene management, and an event system, supporting **real-time simulation of 2000+ autonomous agents**
- Designed a spatial partitioning system using octrees to efficiently cull off-screen objects, detect collisions, and query nearby entities, significantly reducing unnecessary per-frame computations
- Implemented **A* pathfinding over a Sparse Voxel Octree** for AI-controlled drones to navigate around obstacles in 3D
- Created a flow-field crowd simulation where players place directional commands on a grid to guide agents toward a goal, with neighbor separation and distance-based level-of-detail to maintain performance at scale
- Developed a rigid body physics pipeline with broad-phase and narrow-phase collision detection, impulse-based response, and penetration correction for realistic object interactions

Project SlashR (Lead Programmer) | *C++, Unreal Engine 5* *In Development*

- Leading a team of 5 as lead programmer on a **single-player hack-and-slash inspired by God of War**, featuring third-person over-the-shoulder weapon-based melee combat
- Architected a **data-driven combo system** via a reusable combo-tree data assets, letting designers add or rebalance attacks through nodes rather than code
- Built a lock-on **enemy selection system** that scores nearby enemies by distance, screen angle, and line-of-sight to auto-target the most relevant enemy in multi-enemy fights
- Developed **Behavior Tree-driven enemy AI** that coordinates multi-enemy encirclement and dynamically selects attacks from the shared combo system based on player positioning

GlowRenderer | *C++, OpenGL, GLSL* GitHub

- Implemented a complete GPU-accelerated **deferred rendering pipeline using OpenGL framebuffer objects**, enabling efficient rendering of unlimited light sources
- Added frustum culling with octree spatial partitioning and instanced rendering, **reducing draw calls by 60%+**
- Developed PBR metallic-roughness workflow with custom GLSL vertex/fragment shaders implementing Cook-Torrance BRDF, GGX normal distribution, and Schlick Fresnel approximation for physically accurate material rendering

Technical Skills

Languages: C/C++, C#, GDScript, Python, Go, Java, JavaScript/TypeScript, Bash, SQL

Engines: Unreal Engine 5, Unity, Godot

Graphics & Rendering: OpenGL, DirectX, Vulkan, GLSL

Other Tools: Git, Perforce, Docker, Linux, PostgreSQL, Redis