Project Brief: FPS Game Development

Project Title: *Office Havoc: Pen & Paper Combat*

Objective:
Develop a fully functional first-person shooter (FPS) game set in a business office environment. The game will feature unique projectiles such as pens and papers, complex enemy AI, advanced collision detection, and multiplayer capabilities. The project involves building a custom game engine using OpenGL, GLFW, GLAD, and GLM libraries, showcasing expertise in graphics programming, mathematics, AI algorithms, and networking.

Project Scope:
Design and implement an FPS game with the following key components:

- **Custom Game Engine Development**
  - Build a game engine from scratch using OpenGL for rendering, GLFW for window/context creation, GLAD for OpenGL function loading, and GLM for mathematics.
  - Implement core functionalities including object rendering, lighting, camera systems, and physics calculations.
- **AI Movement and Pathfinding**
  - Develop intelligent enemy AI with A* search algorithms for dynamic navigation in a complex office environment.
  - Incorporate behaviours such as patrolling, chasing, and obstacle avoidance using raycasting for collision detection.
  - Utilize mathematical models for AI decision-making and state transitions based on environmental inputs.
- **Collision Detection**
  - Implement collision detection using raycasting for precise interactions between the player, enemies, and environment.
  - Integrate bounding volume hierarchies and response calculations for realistic physics-based interactions.
- **Graphics Programming**
  - Use OpenGL to render realistic office environments, including textures, shadows, and dynamic lighting effects.
  - Apply GLSL shaders to create advanced visual effects and enhance the immersive experience.
- **Projectiles and Physics**
  - Design and implement projectiles like pens and papers, replacing traditional bullets.
  - Manipulate physics and gravity to create challenging, impossible levels such as the impossible staircase.
- **Multiplayer Networking**
  - Develop a client-server architecture for real-time multiplayer gameplay.

    - Implement network synchronization for player movements, actions, and in-game events with efficient protocols to minimize latency.
    - Design secure communication channels to prevent cheating and ensure fair play.

Technical Stack:

- **Languages:** C++
- **Libraries:** OpenGL, GLFW, GLAD, GLM
- **Networking:** Custom socket programming for client-server communication
- **Algorithms:** A* search, raycasting, collision response algorithms

Key Deliverables:

- A functional FPS game featuring enemy AI, pathfinding, and collision detection within an office environment.
- A multiplayer mode allowing real-time competition with unique projectiles.
- Comprehensive documentation detailing the game engine architecture, algorithms, and networking implementation.
- A complete game build ready for testing and potential future deployment.

Expected Outcomes:

- A high-performance FPS game demonstrating custom engine development and AI programming skills.
- A multiplayer component showcasing knowledge of network synchronization and client-server interactions.
- A polished project portfolio piece highlighting proficiency in game development, mathematics, and graphics programming.

Project Timeline:
Completion is projected within six months, with milestones including engine development, AI implementation, collision detection, graphics optimization, and multiplayer integration.

Target Audience:
FPS enthusiasts and gamers who enjoy a unique office-themed environment with creative projectiles and challenging physics-based levels.

Project Success Criteria:
The project will be deemed successful if it meets technical requirements, performs smoothly with minimal bugs, and provides an engaging and challenging experience for players.