Enhanced Squad Behaviour in Tactical Action Games

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1. INTRODUCTION

Artificial Intelligence (AI) in games includes behaviours and the decision-making processes of Non-Playable Characters (NPCs) (Rhalibi, Wong & Price 2009). AI in video games has contributed great deal to player enjoyment and immersion, yet challenges remain to improve game AI. In particular, this project focuses on tactical coordination among groups of agents.

A single NPC spawned in play space seems to be believable but when more NPCs are spawned, choreographing NPCs as a coordinated squad in combat becomes a hard problem. Karlsson (2021) describes solving this problem by breaking it down into smaller fundamental problems including deciding what the squad want to achieve, identifying the best member for each required role, finding the best position for member relative to both enemies (i.e. the player) and their team-mates.

This project will delve into background research on AI techniques involving spatial analysis, role assignment, NPC behaviour, and tactical techniques for squad-based combat scenarios. The investigation will involve the design, development and evaluation of a prototype. The goal of this project is to uncover methods for designing and developing squad-based NPCs that can assess situations, have group objectives, and recognise individual team members' strengths and weaknesses. It will also explore how to identify the best team member for unique roles and find the optimal position for engaging, recovering, flanking, and other related manoeuvres, based on the line of fire and other environmental factors, all within the context of a game engine.

2. BACKGROUND

One of the important factors in creating believable AI characters in-game AI, especially in the shooter genre comes from how the agents act and react in the play space. They need to be intelligent and reactive to the current context of the gameplay experience, and make decisions accordingly. In what follows, two key principles that benefit this process will be described.

2.1 Spatial reasoning

Spatial Reasoning elevates decision-making and coordination by giving NPCs more knowledge of the play space through establishing a cell grid or point collection that is weighted based on important gameplay factors such as the availability of cover, open space, combat vector, and others. By examining the environment through the points or a grid, it is possible to identify the optimal location for specific behaviour (Johnson 2017), thereby surpassing the capabilities of traditional pathfinding.

In tactical games NPCs need to work together as a team and perform coordinated movements whilst maintaining their level of cohesion and adhesion. In their talk on ‘Believable Tactics for Squad AI’, Champandard, Dunstan, & Jack (2012) discuss mentioned how spatial reasoning helps determine which teammates should make specific movements, optimizing and maintaining their cohesion and adhesion.

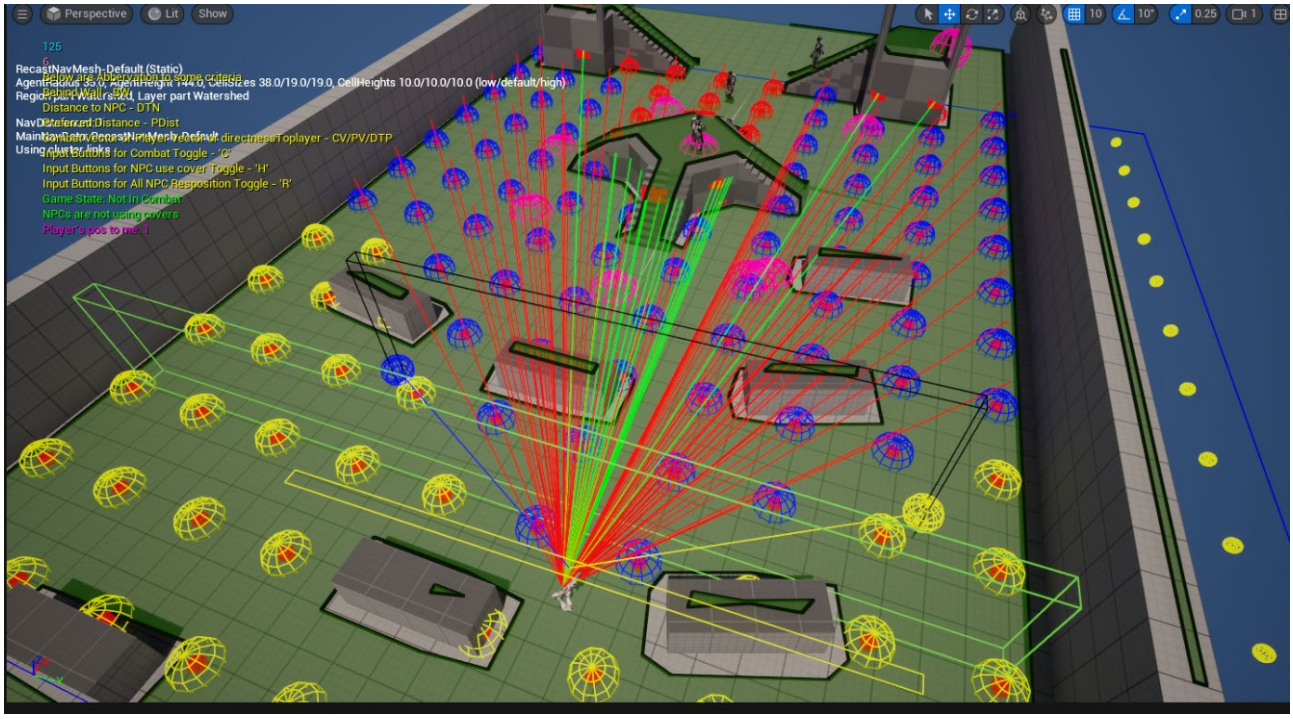

***Figure 1**: Screenshot of the simulation in the editor, where NPC are utilizing the Custom Spatial Reasoning Module considering the player's Field Of View (FOV).*

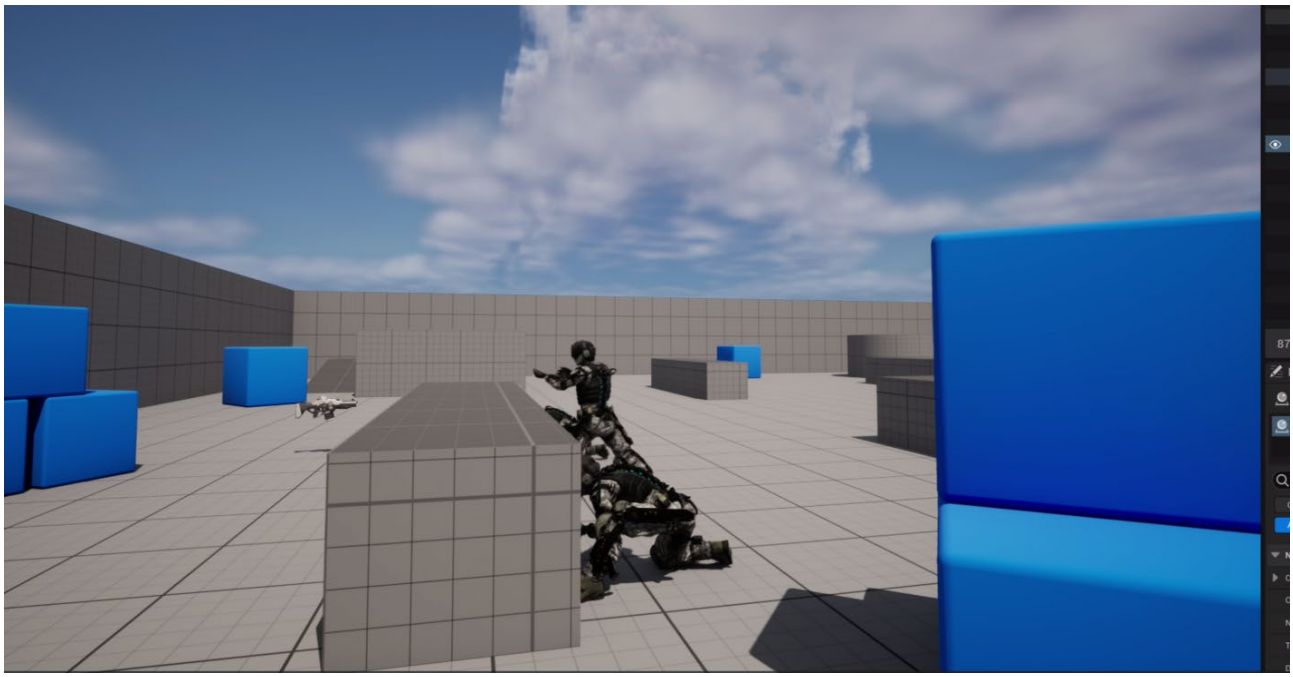

***Figure 2**: Screenshot in the editor, of NPC taking turn at shooting.*

2.2 Role assignment

Some studies suggest that turn-taking and assignment of key roles is crucial for coordinated decision-making in video games and can improve and enhance the overall experience (Champandard, Dunstan & Jack 2012). For instance, according to Dunstan (2012) if a group of NPCs pursues a shared goal that includes a single NPC tasked with cover posting, coordinating between NPCs becomes challenging, potentially leading to less coordination and unwanted emergent behaviours when all contend for the cover posting.

Alternately, we may consider a Combat scenario against the player in a situation where a group 'x'

NPCs are all attacking and potentially, damaging the player. As the player eliminates the NPCs, the combat becomes progressively easier, transitioning into a linear difficulty curve. For a game, this may be unwanted. However, according to Matthew (2017), this issue can be mitigated by assigning the attacking role to only 'n' number of enemies at a time, thereby balancing the difficulty level throughout the gameplay.

3. DESIGN AND DEVELOPMENT OF THE PROTOTYPE

The aim of this project was to investigate how gameplay experience can be enhanced in tactical action video games by designing and implementing enhanced squad behaviour.

The prototype is being developed in the Unreal game engine, which handles the heavy lifting of asset management, graphics etc. For the individual AI, the Unreal behaviour tree system will also be leveraged. A squad coordinator module will be designed to keep track of the play space, spatial analysis and role management.

A custom 'spatial reasoning module' (Figure 1) will generate posts at tools-times, when post-selection is queried. The system collects all the posts and filters them out based on query criteria. The remaining posts are then scored, and it returns the post with the highest score.

The 'role assignment' module (Figure 2) is a sub-module for the squad coordinator where the primary roles (engagers, ambushers and defenders) are assigned to NPCs at load time, and in unique cases at spawn time, when NPCs are spawned in level. Other roles like the 'shooter' and 'flanking' are assigned at runtime based on criteria and current gameplay context.

4. SUMMARY

The objective of this project is to gameplay experience by integrating a custom spatial reasoning module and role assignment into squad behaviours. This should be achieved without adversely affecting the overall gameplay experience (in terms of challenges, playability, and overall game enjoyment). Additionally, the performance should not be affected with a target of 60 frames per second. In case of suboptimal performance, the exploration of spatial hash or bounding volume hierarchies will be considered as options for optimizing the custom spatial reasoning module queries.

5. REFERENCES

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