PUSL3190 Computing Individual Project

Project Proposal

Smart enemy AI for video games

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Chapter 1 – Problem statement

When I was a kid, I got my first PC in grade 3 (2009). In the beginning, I used paints, watched films, and listened to music. After a few weeks, I met a person he introduced me to computer games that year. I played 2000's kids all legendary games for ex-IGI, GTA Vice City, Batman, GTA San Andreas, Age of Empire series, Assassin Creed all series, and Call of Duty series. When I was in OL (2017) one of my school friends gave me the First-person shooter game (FPS) called Call of Duty 4 Multiplayer, in that day changed my life. I am addicted to multiplayer games; I played too many game competitions, after few years of playing Call of Duty 4 I switch the game Special Force 2.

In 2018 our team won 4th place in Sri Lanka Cyber Games (SLCG) and I'm the best sniper player in Sri Lanka, in 2020-2022 I played many game competitions for ex- 1st runners up in inter school game tournament in 2019, 1st runners up in Maximum ladders in 2019, 1st runners up in inter university game in 2021, 2nd runners up in inter university game in 2022. I addicted to the games and played a main character in our team, I'm not the leader I do my best for my teams. I managed to build some skills in playing online games. How the enemy player thinks, what should they do in next move, where they are coming from, what bomb site they go in next round, at what that time have that player in that Connor and aiming. Because I read the enemy players, I can't read the begging of the match after 2 to 3 rounds I read them all. This is my secret of why I'm the best player in online games.

In this case, I figured out something, why am I addicted to online games? it's the same map, same costume, same game mod (Search and Destroy, Deathmatch). When I started playing online games, I was bored with playing offline games, why am I bored with offline games? offline games have a story, different costumes, and different maps, but why am I bored? In that case, I figured out why am I addicted to online games and why I am bored with offline games, in online games same map, the same costume, same game mods but one thing is different a Player. Because players are controlled by humans.

When you need to become a professional gamer you need more several skills, Common sense (at what time an enemy player comes to that corner, where the players go bombsite A or bomb site B), reacting to the what we are hearing (In day to day life we can hear footsteps from our behind we know someone coming from behind), quick thinking (when they come to me what should I do, who kill first, throw a Grande?), what our teammates do (sometimes our teammates how to carry them), counter-attack (imaging enemy player always come from behind(we called that player to a Flanker) how to counter that flank), surprise of element (flank them and surprise) and aiming (when you are good player all the above skills have but you don't have a perfect aim you can't do anything) etc.

Offline game's enemy didn't have that skill, the only thing they did was shoot and hide , spawn same place, coming same place, and reacting to the sound, it's like a hide-and-seek game. That's why online games are enjoyable for me. Because online games have some competitive.

I'm trying to develop the games using Unreal Engine 5, but I don't need a typical offline game. I need to see players are enjoying my games. So, I need an enemy with those skills online player has. In other word smart enemy for my games.

Chapter 2 – Project description

I hope to develop skills the online player has but the offline enemy doesn't. most of the time I get satisfied when kill a player like me, for ex – when playing competitive matches I beat the player who has the same skills as me I get satisfaction and enjoyment, Enjoying means I can think I'm the best, I'm unstoppable like that. I need to describe my project objective I need a game for example.

2.1 Example game

Third-person game (TPS) has a 1700-1800 BC castle, the castle has a priceless gem in the underground of the castle. In castle has 3 doors to in and out. The castle has guards, guards are three types of guards, one holding a sword (knights – melee enemies), the second guard type holding an arrow and bow (archers – ranged enemies), and the third guard type is wizards. The player is a thief like a Robin Hood. In the kingdom, all people knew he was the thief and he acted like Robin Hood (stole money from rich people and gave it to the poor people). The player has two types of weapons one is a sword, and one is an arrow and a bow. The player's main objective is to steal the gem and escape the castle, player can kill the knights and knights can kill the player. The gem room has 2 doors to in and out. Knights are always patrolling, and archers cover the windows.

2.2 Project objectives

- Patrolling and investigating.
  - In this game, knights must patrol what happened in the castle and investigate what they are hearing. Because the castle has many rooms, many roads, many windows, and many stars. Imagine if the player goes in front of the knight and the knight attacks the player until he dead. Otherwise, when a player makes any noise investigate that noise if the guard sees the player attack him until he is dead or the guard doesn't see the player, or any tribble again go the patrol.
- Damage the player.
  - Guards can damage the player.
- Enemy reaction during the player attack
  - In this game players and kights can attack each other, If someone attacks the player, the player can block that attack using pressing the button, develop the enemies can do the same thing, if the player attacks blocks the attack and counters them.
- Group enemy attack
  - The knight sees the player screaming to get other guards help, in knight has hearing range, if any knight in that hearing range they come to that knight for help.
- Mage enemy

- o Mage enemies can dash, fire fireballs, and heal themselves. They are also patrolling.
- Combo attack to the knight
  - o Knights can combine two activities and attack the player, like a long jump attack or, a spinning melee attack.
- Counter the player's entrance.
  - o This castle has 3 doors to in and out, The player goes to the 1st door and dies the during fight next round and has to protect that door using more guards. And knights are not in the same place, they spawn randomly to protect the gem.

2.3 Project keywords

1. Unreal Engine 5.2
2. Behavior tree and Black boards
3. Environment Query System (EQS)
4. Perception System
5. Blueprints

2.4 Future development

- Combine attack with other guards.
  - o Knight sword attack with wizard fireball, knight sword damage increase by wizard something like that.
- Add some keys to open the gem room.
  - o Add 2 keys to open the gem room and, keys are randomly spawning in the map. Guards are protecting that 2 keys. When player die in first round 2nd round counter the player movements.

Chapter 3 – Research Gap

The proposed research project on developing smart enemy AI for video games addresses a distinct set of challenges and objectives compared to existing solutions in the field. A comprehensive literature review has revealed several key areas where this project diverges from the current state of research.

1. Specific Focus on Third-Person Games with Medieval Settings: While there exists research on enhancing NPC intelligence in video games, the specific focus of this project lies in the realm of third-person games set in a medieval environment. Existing studies may cover broader aspects of AI in games, but a targeted examination reveals a gap in the literature concerning the implementation of sophisticated AI behaviors in medieval-themed third-person games.
2. Unique mythology and toolset: This research project introduces a combination of Unreal Engine 5, behavior trees, blackboards, the Environment Query System (EQS), Perception System, and Blueprints to develop and enhance NPC behaviors. The selection and integration of these tools set this project apart from others, which may utilize different engines or AI methodologies.
3. Distinct Game Scenario and Features: This game thief main objective is stealing the priceless gem amidst dynamic and intelligent enemy presence. This specific context, coupled with features like a patrolling, investigate and group enemy attack, distinguishes this project from existing project and research they are focusing on alternative settings or lack certain intricate elements.
4. Integration of Personal Insights and Gaming Experience: When I create this project using my 14 years of gaming experience and personal insight, who has achieved notable success in various gaming competitions. This perspective adds an additional layer of understanding and intuition about player expectations and preferences, contributing a valuable and distinct viewpoint not commonly found in existing research.

3.1 Literature view

The application of a grammar-guided genetic program in "Genes of War" demonstrates a novel approach to evolutionary game development. The adaptability of enemy AI patterns, driven by player performance and dynamically adjusted challenge levels, presents a promising avenue for enhancing player satisfaction. The experimental results highlight the system's efficacy in catering to diverse player profiles and underscore its potential contribution to the broader field of procedural content generation in game development. This research opens avenues for further exploration into adaptive AI systems and their impact on player experiences in evolving game environments. (Font, 2012)

Another paper titled "Optimizing Action RPG Game Difficulty through Grouped Hit-and-Run Enemy AI Strategy by Kristo Radion Purba" in this research delves into the realm of Action RPG games, where players encounter multiple enemies and bosses, striving to gain experience. To heighten the game's challenge, the study proposes an innovative approach to enhance enemy AI strategy, focusing on group dynamics and implementing a hit-and-run strategy against the player. Employing K-Means Clustering and Fuzzy Logic, the research groups enemy units based on attributes and coordinates, maintaining their formation, and adjusting behavior dynamically. When the player approaches a group, the intelligent AI employs retreat tactics while simultaneously launching attacks, creating a nuanced and challenging gaming experience. The study leverages Fuzzy Logic for behavior determination, incorporating factors such as remaining HP, attack, speed, defense, and range. This methodology, rooted in clustering and fuzzy logic, aims to improve the cooperative and reactive abilities of in-game characters, resulting in trickier enemies and contributing to the broader field of game artificial intelligence. The integration of K-Means Clustering and Fuzzy Logic offers a nuanced classification system, emphasizing the potential for creating more sophisticated AI tactics in the context of action-RPG games, ultimately elevating the overall gaming challenge.(Purba, 2016)

(Spronck, Sprinkhuizen-Kuyper and Postma, no date; Schrier *et al.*, 2008; Lim, 2022)

Chapter 4 – Requirements Analysis

1. Basic knowledge of Unreal Engine 5.
2. Behavior Trees & Black Boards in UE5.
3. Environment Query System (EQS) in UE5.
4. AI Controller.
5. Basic idea for 3D model rigging and animations.

Chapter 5 – Finance

This project hasn't any budget because this project only use Unreal Engine 5 and Mixamo web site, both are free to use.

Chapter 6 – External organizations

This project hasn't any external organization.

Chapter 7 – Time Frame

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	OCT	NOV	DEC	JAN	FEB	APR

PLANNING

- PROJECT IDENTIFICATION
- IDENTIFY EXISTING SYSTEM
- IDENTIFY OF TECHNOLOGY
- PROJECT PROPOSAL
- APPROVAL OF PROJECT

ANALYSIS

- BACKGROUND RESEARCH

DESIGN

- DESIGN THE ENEMY AI
- INTERIM REPORT

IMPLEMENTATION

- TESTING
- DOCUMENTATION
- FINAL SUBMISSION

Reference

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4. Schrier, Karen. *et al.* (2008) *Proceedings, Sandbox Symposium 2008 : 3rd ACM SIGGRAPH videogame symposium, Los Angeles, California, August 9-10, 2008*. Association for Computing Machinery.
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