

Coursework Submission Cover Sheet

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Student Number	<input type="text" value="1667866"/>
Module Code	<input type="text" value="CM3203"/>
Submission Date	<input type="text" value="08/02/2021"/>
Hours spent on this exercise	<input type="text" value="5"/>
Special Provision	<input type="checkbox"/>

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Group Submission

For group submissions, *each member of the group must submit a copy of the coversheet*. Please include the student number of the group member tasked with submitting the assignment.

Student number of submitting group member	<input type="text"/>
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By submitting this cover sheet you are confirming that the submission has been checked, and that the submitted files are final and complete.

Declaration

By submitting this cover sheet you are accepting the terms of the following declaration.

I hereby declare that the attached submission (or my contribution to it in the case of group submissions) is all my own work, that it has not previously been submitted for assessment and that I have not knowingly allowed it to be copied by another student. I understand that deceiving or attempting to deceive examiners by passing off the work of another writer, as one's own is plagiarism. I also understand that plagiarising another's work or knowingly allowing another student to plagiarise from my work is against the University regulations and that doing so will result in loss of marks and possible disciplinary proceedings.

FEBRUARY 8, 2021

INITIAL PLAN REPORT

CARDIFF UNIVERSITY – CM3203 - 1667866

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Project description:

The scope of this project revolves around developing a 3D game on Unity engine with Artificially intelligent agents and real time networking built on a dedicated windows server developed in C#.

The game will be a simple combat game and the emphasis of the project is geared towards the AI and **networking capabilities**.

The project could be divided into three main sections:

Firstly, I would need to develop a fully functional game that has basic features such as movement, players interaction (Damage, healing, and physics), a character creation system with a Database that stores all relative information.

Secondly, artificially intelligent agents would be introduced to the main framework with pathfinding capabilities and an implementation of Hierarchical task network planning (HTN) enhanced with chance node calculations. Furthermore, as the AI progresses unique variations of game theory algorithms would be essential to develop for specific types of enemies in the game.

Lastly, real time networking capabilities where the game logic would be processed from a dedicated windows console server built on C# will be built. The server must be fully built on C# without the use of networking solution API's.

Project Aims and Objectives:

- **Create a fully functional game:**
 - The game must have a start menu.
 - The game must have an initial demo map.
 - The game must have a character registration system.
 - Database system to store all information about specific character.
 - The game must have fully controllable 3D character.
 - The character must have full interactions with other enemies and players such as dealing or receiving damage.
 - The game must have an accessible UI that displays all the relative information of the world and the character.

- **The game should have Artificially intelligent agents:**
 - All agents must have path finding capabilities.
 - Specific agents will have uninformed path finding capabilities.
 - Specific agents must have HTN implementations enhanced with chance nodes.
 - Specific agents will have scripted intelligence.
 - Specific agents must have Goal oriented action planning implantation (automated Finite state machines).

- **The game should be fully functional on a dedicated server:**
 - The networking model must be a server-client model.
 - Multiple players must be able to connect to the same instances.
 - The server must have a player authentication method.
 - The server must have a dedicated method to deal with synchronization issues.
 - The AI, physics and simulations of the game must be running on the server side.

Optional:

This section is a discussion of potential implementations if the project is finished earlier than the anticipated deadline and there is enough time to spare. Some of the implementations may be included in the “Polish period”.

This section can be divided into three sections, Game features, AI improvements and Network enhancement.

- **Game Features:**
 - An immersive map for the players to discover, with a mathematical approach to introduce erosion, vegetation, rain, and wind.
 - Physics-Simulated water sources such rivers.
 - Physics-Simulated sky, clouds, day, and night cycles.
- **AI Features:**
 - A reinforcement learning agent that learns the game with minimal input.
- **Networking Features:**
 - A text-based chat system.
 - A voice chat system.

Research:

A vital section of the project, in which time will be spent on researching different avenues of the game, adjusting the scope of the project, and choosing the appropriate tools to create the game. s

Initial framework:

This week would involve completing upon the research and setting up the initial framework of the game. it is vital that the initial framework is set up in an early time frame so that the AI agent's implementation would be integrated into the game as early as possible.

The most important features for the initial framework; start menu, a testing map, a fully functional 3D character that can move in all directions and perform combat moves such as swinging a sword or rolling, character specific information such as health and stamina. it's important to note that the development of the game and its features would always be under processing in parallel with all the other sections.

AI design:

There are many ideas on how an intelligent agent might be developed in a 3D combat-game. This week would be spent researching and investigating the options and the algorithms at hand. It would involve designing specific variations of game theory algorithms.

AI implementation and improvements:

The outcome of the design would determine this phase of development. In these two weeks with a potential overlap of the networking period of development, time would be spent on developing and improving the NPC's and enemies of the game. By the end of this period, the AI of the game should be functional with potential bugs and unexpected behaviors to be resolved in later stages of development.

Networking design:

When the game is fully functional, and the game AI is running as intended, networking the game would start, in this phase there will be a focus on restructuring the code to suit the networking design. Furthermore, a lot of time would be spent refining the ideas and choosing the correct tools.

Networking implementation improvement:

After the code is ready to be translated into the server code, these two weeks would involve developing the server-client model, while testing and implementing necessary methods to solve potential synchronization issues. By the end of these two weeks the game should be ready to ship, build and played online. If finished earlier than set deadline development of optional features would immediately start.

Polish:

A safety net week to play, test and refine the project. This may include adding more optional features. With an approach that suits the deadline of the final report.

Report writing:

The last stage of the project, where all work would be documented into an academic report explaining the design philosophy, the game features, AI-Agents, and the networking solution. Lastly, a commentated video recording would be created explaining all the aspect of the game and it is features, displaying a demo of two online players against different AI-Agents.