**Student Name**

Lewis Wilden

**Proposed Final Project Title**

Creating Guard AI Suitable For A Stealth Game

**Development Blog URL**

https://guardaiproject.wordpress.com/

**Brief Outline of Work**

This project is an exploration and creation of an Artificial Intelligence suitable for a guard within a stealth based game. The essence is to create a set of rules for the guard so it can patrol, detect, chase and attack the player character. I will also create a gameplay scenario to play-test the implemented algorithm and documents feedback from player, this will allow me to fine-tune the algorithm to suit its purpose.

This project will be based in the Unity3D engine using the C# programming language, the reasoning behind this is I have more experience with the Unity engine and I’m more confident with C# than other languages. Also, the job positions I was searching for wanted evidence of Unity3D and C# knowledge.

The following areas of research will be vital to this project:

**Finite State Machines**: The FMS will handle the decision making for the guard, researching the methods for creating FMS and the ways to change the states at the correct time is crucial. Having the guard start in an idle/patrol state and changing to aware state if it notices something out of place e.g. open door, then moving to alert state if the player is seen or heard.

**Pathfinding**: Creating a method for the guard so it can follow a patrol system and chase the player if caught. Also, how will the guard react to walls/objects, jumping or climbing up/down walls. If the player is heard how will the guard know what direction it is coming from and what the optimal path is.

**Multiple Guards:**

When starting the project, I will only include a single guard, depending on time scale I may consider implementing more than one. However, doing this will require more research on how these agents will react to each other, e.g. differentiating the path they take to chase the player and not overlapping other guard patrols.

**C#**: The reasoning for using C# for this project is mainly focused around the jobs I was researching, also using the Unity3D engine limits the languages I can use. I will research techniques to keep the project optimized and reduce the amount of bug fixing.

**Unity3D:** A feature of Unity3D that I haven’t used that will be required is the Unity NavMesh, researching this to specify where the guard and players are able to walk. Also, how the NavMesh reacts to obstacle like walls, doors and gaps in the plane will be helpful.

**Game Mechanics**: What are the current mechanics in stealth based games, how do they handle decision making and pathfinding. How can the player interact with the guard or the world to make it a stealth game. How does the player sneak pass the guard, or hide from the guard. This research is vital for making project, hopefully creating a believable guard AI for a stealth based game.

**Rationale For The Project**

The reasoning for undertaking this project is programming interest me academically, professionally and personally, this project will demonstrate my skill in the C# language and the Unity engine. AI is very interesting because it plays a vital role in single player games today, providing players a challenge depending on the complexity of the AI.

**Job Research:** The jobs I have been researching have been based around game development in Unity, Game designer and QA Tester.

**Common Job Requirements**:

Unity 3D /Unreal knowledge

Programming experience in C# or C++

Ability to implement and iterate quickly and effectively

I have experience in creating projects in Unity3D using the C# language over the years of my study’s, and can quickly implement mechanics to test and iterate them. I will demonstrate my knowledge of these skills in this project.

**Overall Assessment Criteria:**

Expectantly the final project will include the following features:

A guard AI patrolling around certain points

A player character that can move around the level

A guard AI that reacts to player interactions

AI that can change states depending on the interaction

Ability to fine-tune and test the AI

Create an AI that suits a stealth based game

**Annotated Bibliography**

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|  | **Bibliographical item** | **Summary** |
|  | Basilico, N., Gatti, N. and Amigoni, F. (2012).  Patrolling security games: Definition and algorithms  for solving large instances with single patroller and single intruder.  *Artificial Intelligence*, [online] 184-185, pp.78-123.  Available at: https://pdfs.semanticscholar.org  /2041/0e7ac4b93797e5fd705fd32b5910601f9fad.pdf  [Accessed 1 Oct. 2017]. | This article discusses the optimal ways of implementing a single patroller (guard in my case) and a single intruder (The Player) in a patrolling security game. The authors discuss the overall game model and a basic algorithm. |
|  | Buckland, M. (2009). Programming game AI by example. Plano, Texas: Wordware Publ. | This book discusses the practical way of creating an AI algorithm. The book contains pseudo code which allows for easy translation for multiple programming languages. |
|  | Kehoe, D. (2015). *Designing Artificial Intelligence for Games (Part 1)*. [online] Software.intel.com. Available at: https://software.intel.com/en-us/articles/designing-artificial-intelligence-for-games-part-1 [Accessed 5 Oct. 2017]. | Discusses the ways of designing an artificial intelligence system in games ranging from simple to advanced. Also discusses finite state machines which will be a big factor in my project. |
|  | Kehoe, D. (2015). *Designing Artificial Intelligence for Games (part 2) | Intel® Software*. [online] Software.intel.com. Available at: https://software.intel.com/en-us/articles/designing-artificial-intelligence-for-games-part-2/ [Accessed 5 Oct. 2017]. | Offers advice on AI perceptions and AI Navigation. It discusses the implementation of sight and sound for the AI, both will be included in my project. The author also discusses the A\* algorithm for pathfinding. |
|  | Kirby, N. (2011). *Introduction to game AI*. Australia: Andover. | Introduction to AI, demonstrates the concept of designing and implementing AI. Great for learning the basics to increase my knowledge of the subject. |
|  | Leonard, T. (2003). *Building an AI Sensory System: Examining The Design of Thief: The Dark Project*. [online] Gamasutra.com. Available at: https://www.gamasutra.com/view/feature/131297/building\_an\_ai\_sensory\_system\_.php [Accessed 5 Oct. 2017]. | Discusses how the game Thief uses multiple vision modes. Searching whether a door has been opened the last time it saw it, or an object has been moved. |
|  | Millington, I. and Funge, J. (2016). *Artificial Intelligence for Games*. London: CRC Press. | Brings extensive professional experience to the problem of creating and improving the quality of AI in games. He discusses numerous examples from real games and explores the underlying ideas. |
|  | Palacios, J. (2016). *Unity 5.x game AI programming cookbook*. Birmingham: Packt Publishing. | Presents essential and niche techniques for AI programming. The book contains techniques on navigation, decision making, vision and hearing capabilities and creating a more humanlike AI behaviour. |
|  | Smith, M. and Queiroz, C. (2015). *Unity 5.x cookbook*. Birmingham: Packt Publishing, pp.257-303, 309-350, 433-480. | The book gives an overall introduction to Unity and teaches more complex feature throughout. Chapter 7 talk about controlling the animation, which will be needed for the guard and the player. Chapter 8 discuses Position, Movement and navigation. Chapter 11 teaches numerous of ways to optimize the project. |
|  | Tremblay, J., Torres, P. and Verbrugge, C. (2014). Measuring Risk in Stealth Games. In: *International Conference on the Foundations of Digital Games*. [online] pp.1-8. Available at: http://www.fdg2014.org/papers/fdg2014\_paper\_33.pdf [Accessed 1 Nov. 2017]. | The article talks about how to create a stealth based level but taking the difficulty scale into consideration. Discusses the optimal distance for the guard to notice the player, but take obstacles and walls into consideration. |

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| **Use this grid to plan your project milestones** | | |
| **2017 – 18** | **Week #** | **Milestone Deliverables and Tasks** |
| 25 – 29 Sept | Week 1 | Research current AI in game today |
| 2 – 6 Oct | Week 2 | Find research materials for the project |
| 9 – 13 Oct | Week 3 | Find research materials for the project |
| 16 – 20 Oct | Week 4 | Find research materials for the project, Plan Proposal |
| 23 – 27 Oct | Week 5 | Find research materials for the project, Plan Proposal |
| 30 Oct – 3 Nov | Week 6 | Find research materials for the project, Plan Proposal |
| 6 – 10 Nov | Week 7 | Submission of Final Project Proposal: by noon, Friday 10 Nov 2017 |
| 13 – 17 Nov | Week 8 | Research and design behavioral system. Install any standard assets I need for the project |
| 20 – 24 Nov | Week 9 | Implement basic guard movement, add patrol system |
| 27 Nov – 1 Dec | Week 10 | Start Guard vision |
| 4 – 8 Dec | Week 11 | Test and improve guards vision |
| 11 – 15 Dec | Week 12 | Implement Guard Hearing |
| 18 – 22 Dec | **Mid-Winter Festival** | |
| 25 – 29 Dec |
| 1 – 5 Jan |
| 8 – 12 Jan |  | Test and improve guard hearing |
| 15 – 19 Jan |  | Create FSM for the mechanics |
| 22 – 26 Jan | Week 13 | Continue with FSM creation, Guard attack |
| 29 Jan –2 Feb | Week 14 | Create presentation |
| 5 – 9 Feb | Week 15 | **Seminar Presentations TBC** |
| 12 – 16 Feb | Week 16 | **Seminar Presentations TBC** |
| 19 – 23 Feb | Week 17 | Make necessary change depending on Seminar outcome |
| 26 Feb – 2 Mar | Week 18 | Play-testing/Bug testing |
| 5 – 9 Mar | Week 19 | Play-testing feedback implementation |
| 12 – 16 Mar | Week 20 | Bug Fix/Polish |
| 19 – 23 Mar | Week 21 | Bug Fix/Polish |
| 26 – 30 Mar | **Spring Fertility Festival** | |
| 2 – 6 Apr |
| 9 – 13 Apr | Week 22 | Submission of Final Product and Blog: by noon, Friday 13 Apr 2018 |
| 16 – 20 Apr | Week 23 |  |
| 23 – 27 Apr | Week 24 |  |