

Pathfinding

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# Changelog

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| --- | --- | --- |
| **Version** | **Date** | **Changes** |
| 1.0.0 | 06/05/2022 | Initial Setup, specifying document concept and author |
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# Introduction

## Rationale

The purpose of this TDD is to learn and understand more about artificial intelligence and search algorithms by utilising a number of different game engine objects to present challenges to the AI agents for them to overcome while using the algorithm(s).

## Background

The object-oriented programming language, C#, has had many different versions in the past forming its basis roughly off C. Different versions slightly affects the ways in which some code concepts are written. In this project I will be using version 9.0.

Like C#, Unity has had many iterations in the past and continues to update to this day, but for this project I will be using Unity version 2020.3.27f1

According to a [Harvard University blog post](https://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/), and Wikipedia, AI and machine learning have been around for a few centuries, though the foundation of AI as an actual science was coined in 1956. Alan Turing, a brilliant mathematician, was highly influential to its foundation and development. Nowadays AI is being used in almost anything with a processor – watches, phones, computers, TVs, cameras, etc. As of 2022, the world’s first robot AI was born in 2018 and still lives to this day.

In this project I will be designing and producing a working project within Unity from scratch, starting with this document. I will be using Unity’s built in AI functions and incorporating the A\* search algorithm.

## Terminology

**C#** - An object-oriented programming language

**Unity** – a game engine used in the production of games and software in the IT industry

**TDD** – a Technical Design Document (this document) is a document that aids in the critical analysis of a problem that is presented to a development team and the proposed solution, while also communicating priority and effort of tasks, and impact with various stakeholders.

**AI** – Artificial Intelligence is human intelligence demonstrated in machines, able to reason and carry out tasks based on inputs as a human would.

**OS** – Operating System of a computer or electronic device

**Processor** – essentially a computer’s brain for calculating and input/outputs of the software running on the computer

## Non-Goals

* Add sound effects and dialogue
* Add a timer
* Add particle effects

## Proposed Design

The project will have a few key elements from classwork implemented such as the NavMesh and related components, as well as some of the code structure. There will be 3 AI agents: two key searchers and one agent searcher. The project will be structured within a constructed maze that the AI must navigate through; the key searcher agents will search for key pickups, and the agent searcher will search for the other AI agents.

The objective for the key searchers is to retrieve one key each and get to the end of the maze. The objective for the agent searcher is to find the other AI agents and stop them achieving their objectives.

The agent searcher will be placed randomly on every scene play, and the key searchers start in the same place every run.

## Software and Hardware Requirements

**OS**: Windows 7 or Greater

**Processor**: Intel Core i3-12100, AMD Ryzen 3 3300X, or equivalent

**Memory**: 4 GB RAM

**Graphics**: Integrated Graphics Chip (minimum Nvidia GTX 700 series or AMD Radeon R7 200 series)

**DirectX**: Version 9.0

**Storage**: 1 GB available space

# Research

* Find 5 major AI jargon of your choice used within the games industry. List and describe the major AI terms.
* Describe what an algorithm is, and how do you use algorithms when programming?
* Define what is a search algorithm and a sorting algorithm.
* What is big O notation?
* Outline the difference between 3 different pathfinding algorithms.
* Describe how object-oriented programming and inheritance could be used to create AI.
* Outline the development process for creating AI strategies for NPCs in a game.

# System Architecture

## Architecture Diagram

/Diagram of the planned system – This is like a mind map or flow chart of what you are going to make or what you need to do/

## Interface/API Definitions

/ Describe the various components and libraries you will be using that are inbuilt into unity. For example, GameObject, Image, SceneManagement, UnityEngine…etc. Link the Unity API Manual to show where to find information on those elements. /

## Risks

/ If there are any risks or unknowns, list them here. Also, if there is additional research to be done, mention that as well. /

## Alternatives

/ If there are other potential solutions which were considered and rejected, list them here, as well as the reason why they were not chosen. /

# Sign Off

Name

[Name of appropriate person approving the software]

Role

[Click/tap to select role]

Signature

Date

[Click/tap to select date]

# Testing

## Errors and Buggs

Outline the test classes used. Add rows to table as required.

|  |  |  |  |
| --- | --- | --- | --- |
| **Class Name** | **Description of Error** | **Screenshots of testing** | **Solution** |
| [Name of Class or Object that the error is connected to] | [Description of the error/error message] | [Add and resize relevant screen shots] | [Explain solution/fix to error] |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# Evaluation

## Reflection

/Provide a self-reflection on your performance. /