

Computer Games Development

Software Functional Specification

Year IV

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**DECLARATION**

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# Introduction

The objective of this project is to compare the benefits and drawbacks of using commonly used heuristic based guided pathfinding algorithms to the incremental algorithm known as Dstar Lite. This project will discuss the direct benefits of each algorithm in depth, from Astar, Dijkstra's search algorithm, Lifelong Planning Astar, and the non-guided algorithm known as Depth First Search when compared to D star Lite within a game’s context.

# Technical Design

The purpose of this document is to effectively communicate the technical details and design decisions of the system/algorithm to the readers.

It could include software architecture, algorithm design, class specifications, pseudo code, etc. with tools such as UML, Class Diagram, CRC Cards.

## Header Files

|  |  |
| --- | --- |
| Helper classes and structs code images | Description |
|  | The Enum class called “WhichAlgorithm” which controls which algorithm is being used a certain time. This Enum class contains the name for every pathfinding algorithm in the project. |
|  | The Enum class called “GridSize” controls the size of the grid which is being used in the program ranging from “small” to “very Large”.  “small” = “10x10” grid  “Large” “50x50” grid  “Very Large” = “100x100” grid |
|  | This Enum class called “Race” depicts whether you want to race the algorithms in comparison to dstar lite on a chosen path |
|  | The Enum class called “debug” toggles whether the user wants to see the variable values for Dstar Lite on the screen. This is only available with the small grid size |
|  | The struct called “Screen Size” struct which controls the size of each window |
|  | The Enum class called “Mode” which controls which mode the application is in. behaving differently depending on which one it is in |

Table 2‑1 Description Of The Helper classes and structs code

|  |  |
| --- | --- |
| Utilised class images | Description |
|  | Public variables of Cell Class  The header file for the Cell(node) which has all the current functions in use.  Part A |
|  | Public variables of Cell Class  the header file for the Cell(node) which has all the current functions in use.  Part B |
|  | Public variables of Cell Class  the header file for the Cell(node) which has all the current functions in use.  Part C |
|  | Public variables of Cell Class  the header file for the Cell(node) which has all the current functions in use.  Part D |
|  | Public variables of Cell Class  the header file for the Cell(node) which has all the current functions in use.  Part E |
|  | Private variables to Cell Class |
|  | private member variables of the grid class |
|  | public members of the Grid class  Part A |
|  | public members of the Grid class  Part B |

Table 2‑2 Description Of The Utilised Class Images

|  |  |
| --- | --- |
| Algorithm’s classes: UI and games class images | Description |
|  | Functor used in Dstar Lite |
|  | Private members of the Dstar Lite Class |
|  | Public members of the Dstar Lite Class |
|  | Functor used in “Astar”.  It compares each cell based on their hcost + their gcost and returns the lower of the two. |
|  | “Astar” class as declared in the header file |
|  | Functor used in “LpaStar”. |
|  | Private members of the  Lifelong Planning Astar Class |
|  | Public members of the  Lifelong Planning Astar Class |
|  | Functor used in “Dijkstra’s” search algorithm.  It compares each cell based on their gcost and returns the lower of the two. |
|  | “Dijkstra’s” Class as declared in the header file. |
|  | “Depth First Search” Class as declared in the header file. |
|  | “Menu” class as private member variables in the header file.  Part A |
|  | “Menu” class as private member variables in the header file.  Part B |
|  | “Menu” class as public member variables in the header file. |
|  | Public members to class “Game”, as declared in the header file.  Part A |
|  | Public members to class “Game”, as declared in the header file.  Part B |
|  | Private members to class “Game”, as declared in the header file.  Part A |
|  | Private members to class “Game”, as declared in the header file.  Part B |

Table 2‑3 Description Of The Code

## Storing of Data

### How is the Data Stored?

The Data is stored inside of an excel file for each algorithm. It sores the time which it takes for the algorithm to complete the path in seconds. Each algorithm has three separate excel files for the times stored on the three separate grid sizes from small, medium and large grid sizes and as such the times stored reflect this.

### When is the Data Stored?

The Data is stored after the algorithm has been run and the user can also select the testing mode which will give the algorithms a random start and end position. This will avoid any positional or path length bias as the path is completely randomised on the grid.

The Data was then collected and used for comparison purposes.

|  |  |
| --- | --- |
| Code/File/Data Storing Images | Description |
|  | Example for the data stored in the excel file.  The example is the data stored in “AstarTime.csv” this is the data collected on the small grid running the Astar Algorithm |
|  | Example of the name of the algorithms excel file |
|  | Example of how the algorithm times is stored in code.  Description of code: This code collects the time taken for the algorithm to finish then inputs that time into the excel sheet. |

Table 2‑4 Storing Of The Data

# Class Diagram

Diagram

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Figure 3‑1 Class Diagram

# CRC Cards

Graphical user interface, text, application, email

Description automatically generated

Figure 4‑1 CRC Card "Grid"

Graphical user interface, text

Description automatically generated

Figure 4‑2 CRC Card"Game"

Graphical user interface, text, application

Description automatically generated

Figure 4‑3 CRC Card "Menu"

Table

Description automatically generated with medium confidence

Figure 4‑4 CRC Card "Astar"

Graphical user interface, text, application

Description automatically generated with medium confidence

Figure 4‑5 CRC Card "Dstar Lite"

Graphical user interface, text, application

Description automatically generated

Figure 4‑6 CRC Card "Dijkstras"

Graphical user interface, text

Description automatically generated

Figure 4‑7 CRC Card "Depth First Search"

Table

Description automatically generated with low confidence

Figure 4‑8 CRC Card "Lpa Star"

Table

Description automatically generated with medium confidence

Figure 4‑9 CRC Card "Cell"

Text

Description automatically generated

Figure 4‑10 CRC Card "Screen Size"

Graphical user interface, text, application

Description automatically generated

Figure 4‑11 CRC Card "Mode"

Table

Description automatically generated with medium confidence

Figure 4‑12 CRC Card "Debug"

Table

Description automatically generated

Figure 4‑13 CRC Card "Race"

Text, table

Description automatically generated with medium confidence

Figure 4‑14 CRC Card "Grid Size"

A picture containing graphical user interface

Description automatically generated

Figure 4‑15 CRC Card "Which Algorithm"

# Sequence Diagram

Diagram, box and whisker chart

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Figure 5‑1 Sequence Diagram