



CSE 472 Artificial Intelligence

*Searching Algorithms Program*

# PROJECT DOCUMENTATION

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## **0. Introduction**

The program is written in Python using PyQt5, Qt Web Engine, PyQt5 Tools and Pyvis libraries. The project is then converted into a '.exe' file using pyinstaller. This '.exe' file is bundled with python and all the libraries needed for the code to run. In addition to the '.exe' file, a resource folder is required to be next to it named "res".

This exe bundle can be found on [CSE472 Project EXE.rar](#)

The project source code can also be found on [GitHub - Anthony-Amgad/CSE472-Project](#)

Before testing the source code please make sure you have python installed as well as the required dependencies.

Here's a link to install python [Welcome to Python.org](#)

Here's a list of cmd commands to install all required dependencies after installing python:

- `pip install PyQt5`
- `pip install PyQtWebEngine`
- `pip install pyqt5-tools`
- `pip install pyvis`

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# 1. Main Window

This is the window that you are first met with when the program opens. If you hover with your mouse cursor over the label “Hover Over Me!”, a box will show up with the students and their ids who worked on the project.

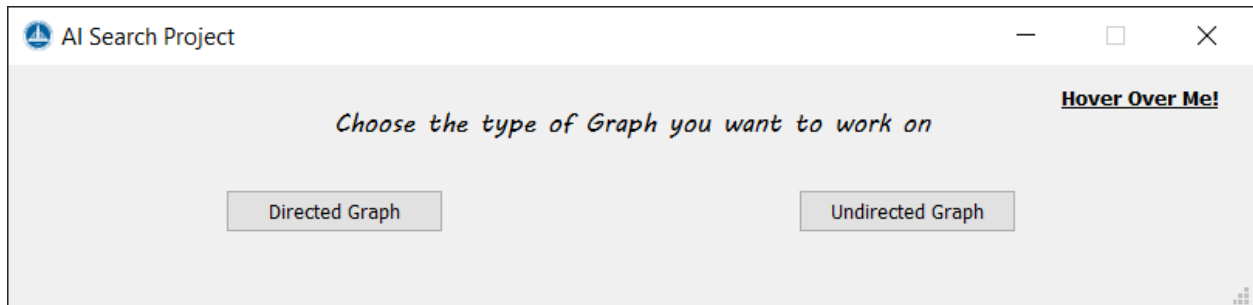


Figure 1: Main Window

The following buttons “Directed Graph” and “Undirected Graph” allows you to test the searching algorithms on their respective graphs opening the graphing window for each with slight differences that will be stated later.

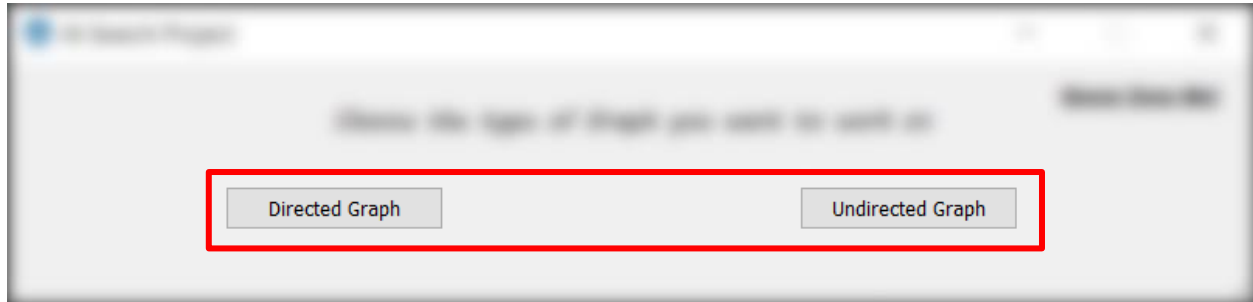


Figure 2: Main Window Buttons

## 2. Graphing Window

This is the window shown for the directed graph option. The differences will be stated in another section in the guide.

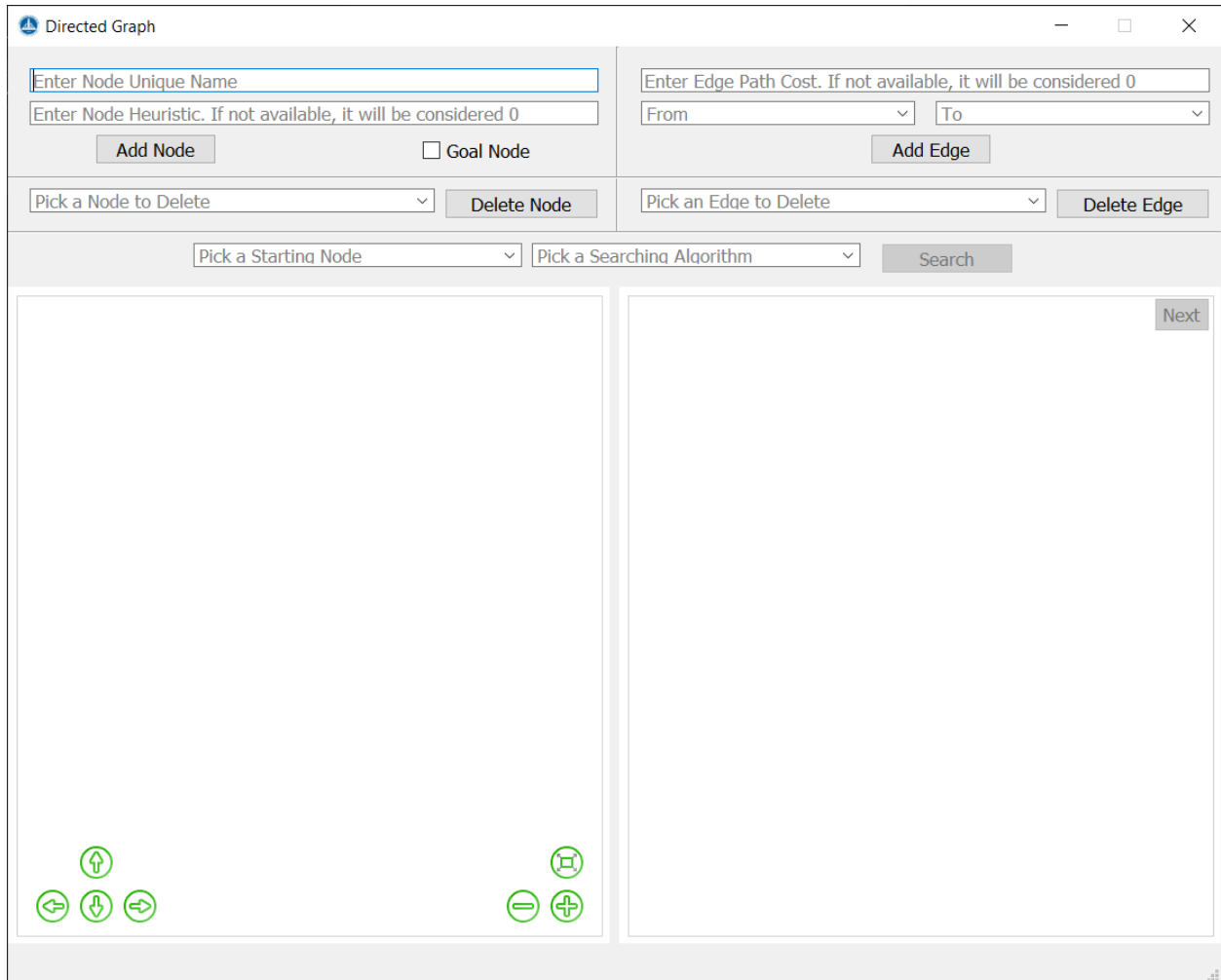


Figure 3: Graphing Window

The UI is made for simple understanding and to be user friendly with placeholder text on all the input elements for understanding their use.

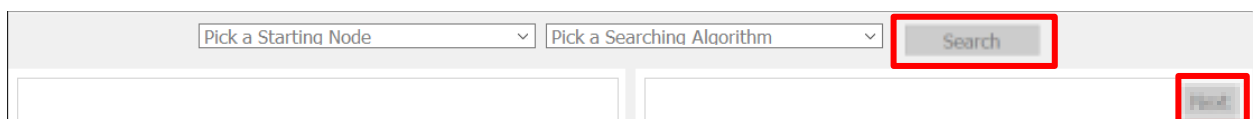


Figure 4: Initially Disabled Buttons

As you can the search button is disabled because a valid graph has not been entered yet (at least 1 goal node and at least 1 regular node). The next button is disabled because we have not entered a search yet to show the animation.

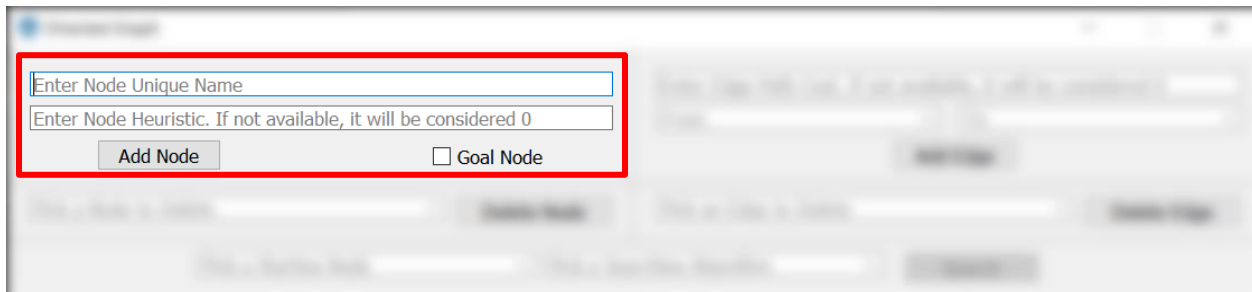


Figure 5: Adding Node Section

This section of the GUI is to allow the adding of nodes. Each node requires a node and a heuristic. If a heuristic is not entered it will be considered zero. If the “Goal Node” checkbox is checked. It will auto lock the heuristic to be 0. When the “Add Node” button is pressed nodes are shown as in the next figure.



Figure 6: Graph Viewer

What is before the ‘:’ is the Node name followed by its heuristic. If a Node is yellow, then it’s a goal node.

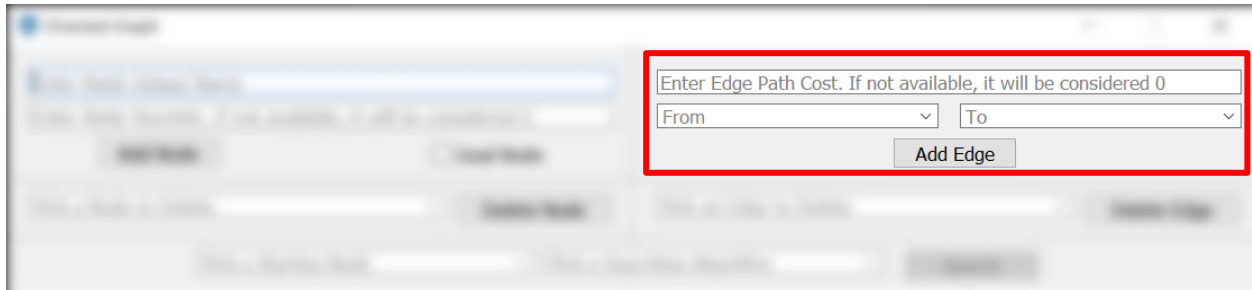


Figure 8: Adding Edge Section

This section of the GUI allows for entry of edges. Each edge requires 2 nodes to connect and a path cost. If the path cost is not entered by the user, it is considered 0.

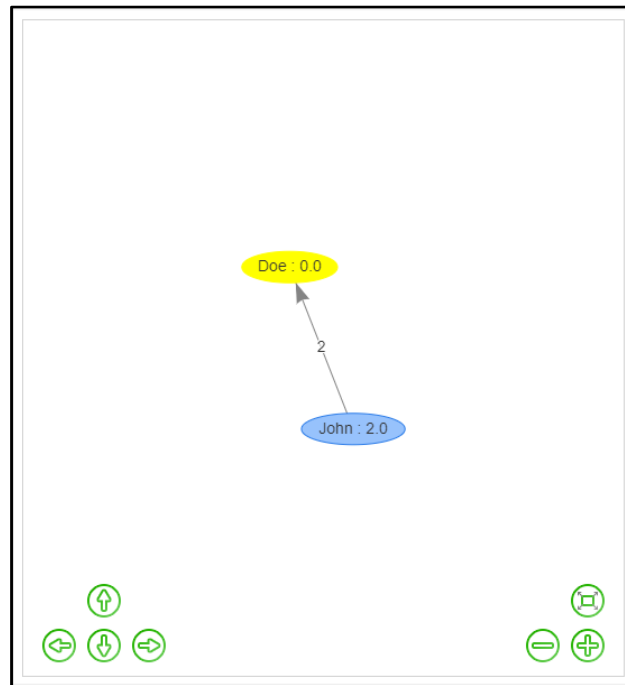


Figure 7: Graph Showing Edge Addition

The line representing the edge is labelled with the assigned path cost.

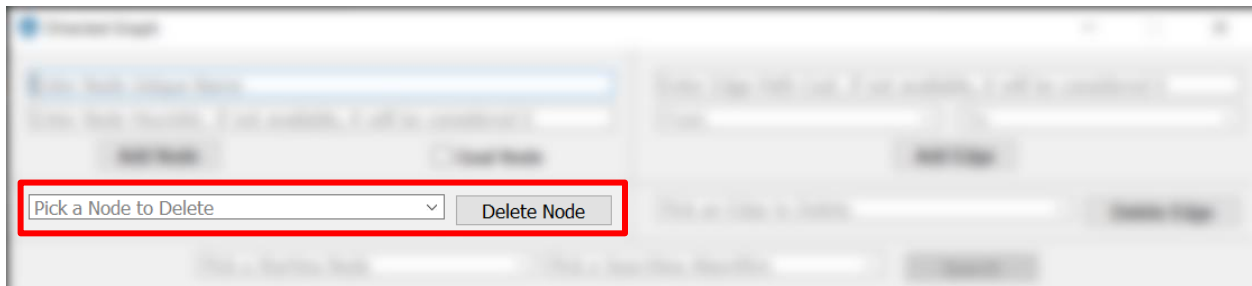


Figure 9: Deleting Node Section

This section allows you to pick from the combo box a node to delete. After pressing the button, the node and any edges that were connected to it will be removed from the graph viewer.

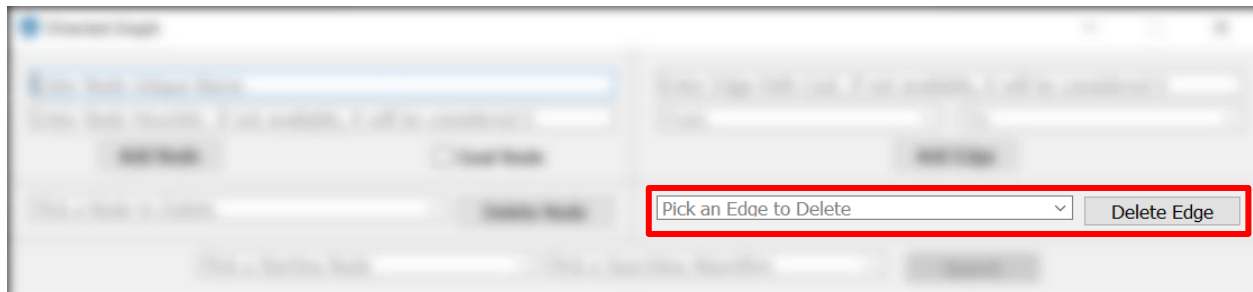


Figure 11: Deleting Edge Section

This section allows you to pick from the combo box an edge to delete. After pressing the button, the picked edge will be removed from the graph viewer.

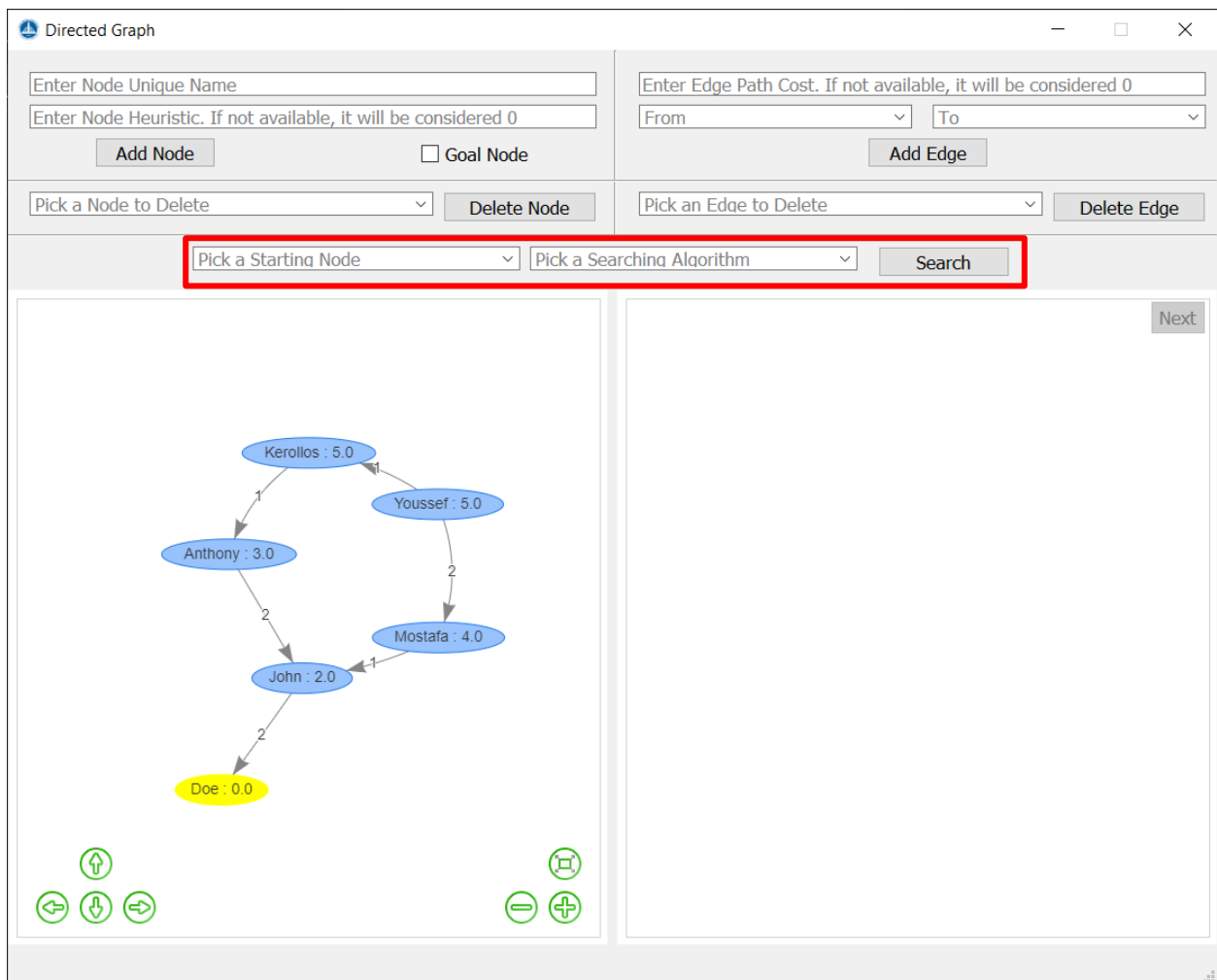


Figure 10: Searching initialization

After entering the graph, the user has to pick a starting node and a searching algorithm then press the “Search” button.



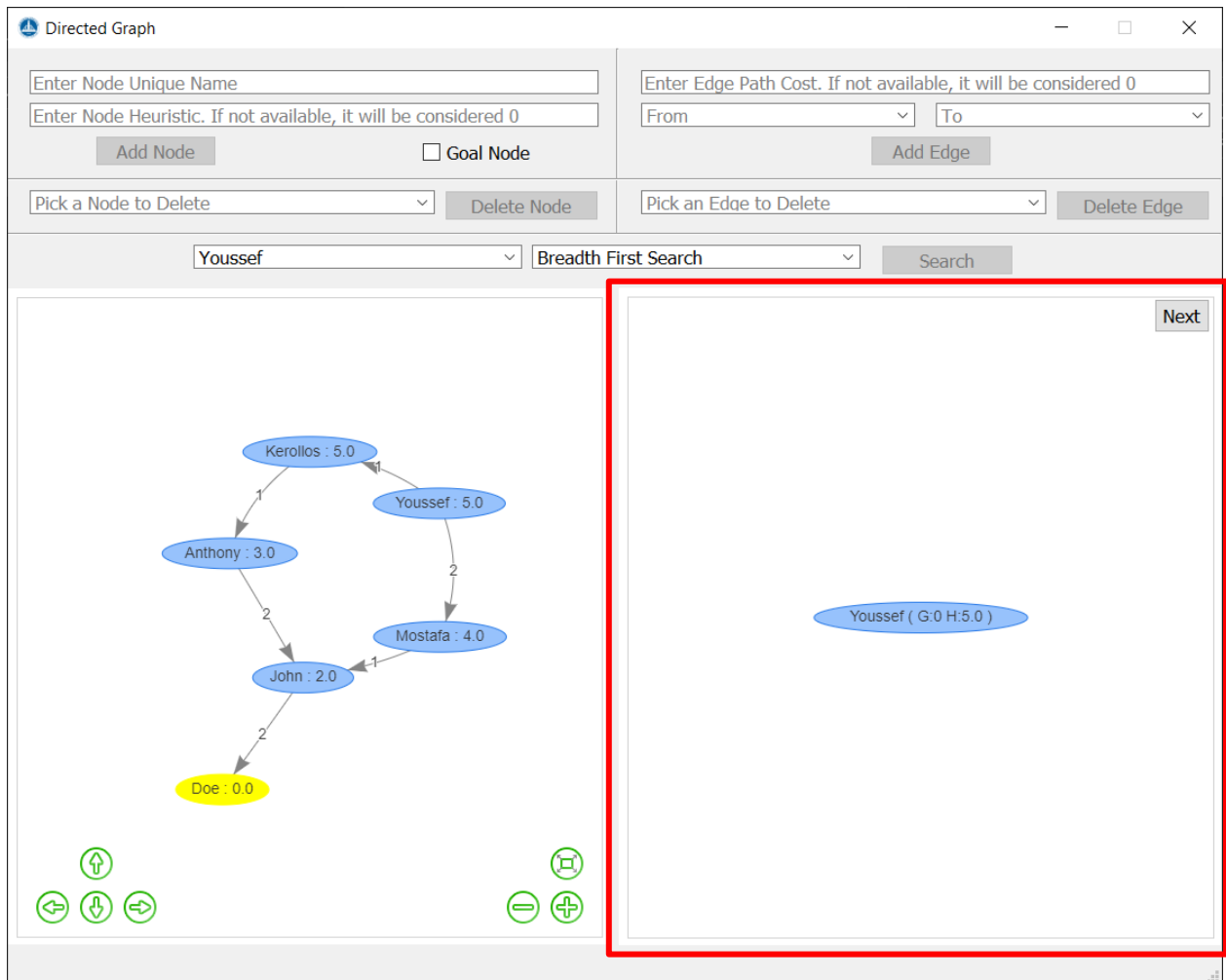


Figure 13: Starting Search

After starting the search, the starting node appears on the Tree Viewer on the right. Clicking the “Next” button will show the expansion process as in the following figure.

As you can see, expanded nodes are colored in green. This process of clicking the “Next” button continues until a goal node is expanded. Afterwards, a message box appears showing the found path to the goal node.

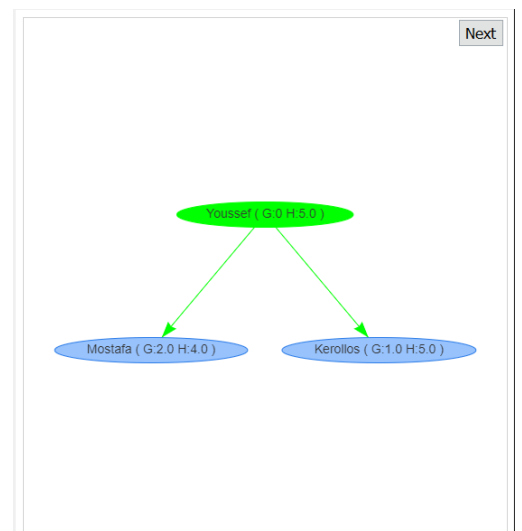


Figure 12: Tree View

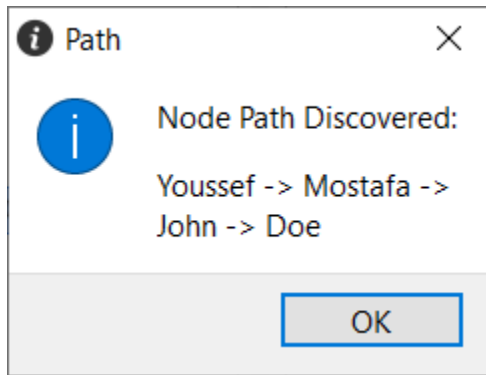


Figure 15: Message Box with Path

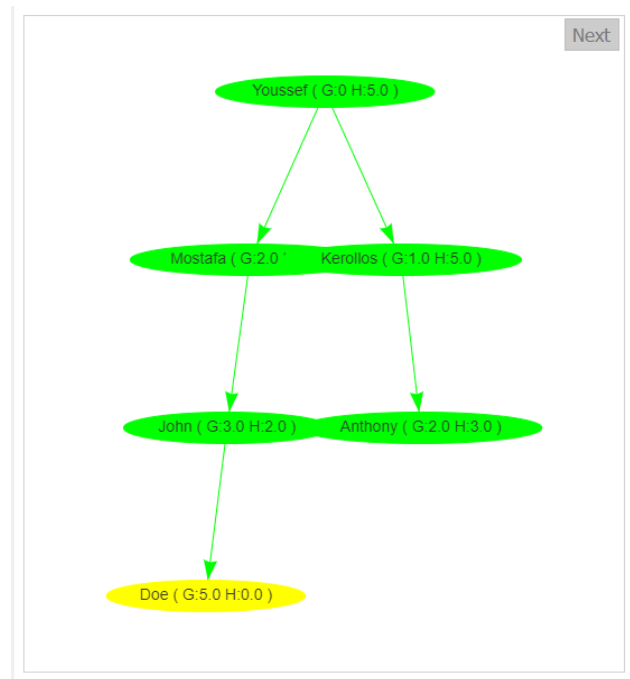


Figure 14: Tree View after reaching a goal node

If a path cannot be found the following message will appear:

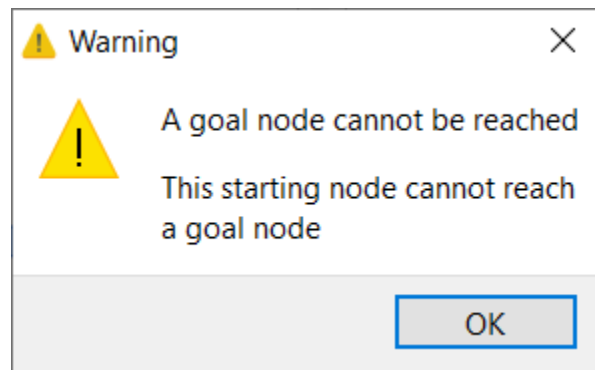


Figure 16: No path warning

If at any point the tree appears in a straight line like structure, that is because 2 expanded nodes are the same causing them to have the same children. You can interact with both the tree and graph moving nodes around.

### 3. Differences between Directed and Undirected:

There are 2 main differences in GUI between choosing directed and undirected. The first one is shown when picking nodes for the Edge addition.

<input type="text" value="Enter Edge Path Cost. If not available, it will be considered 0"/>	<input type="text" value="Enter Edge Path Cost. If not available, it will be considered 0"/>
<input type="text" value="From"/>	<input type="text" value="To"/>
<input type="button" value="Add Edge"/>	<input type="button" value="Add Edge"/>

Figure 17: Adding Edge Difference

In the undirected version it doesn't matter in which combo box the nodes will be added. On the other hand, in the directed version it does, as the user must choose where the arrow goes "From" which node "To" which node.

Another difference can be seen in the graphs themselves.

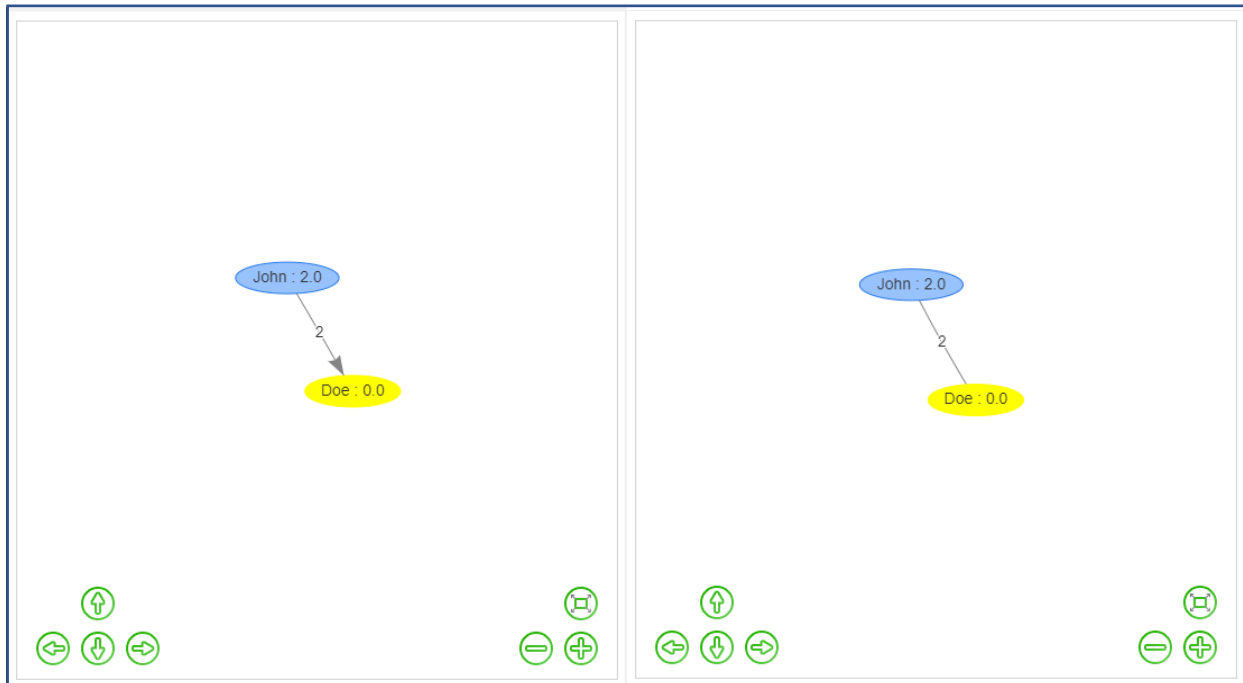


Figure 18: Graph Difference

In the directed graph the arrow shows that the movement only goes 1 way (In this example only from John to Doe). However, in the undirected graph a line shows that the movement can go both ways (In this example both from John to Doe and vice versa).