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Advanced Shortest Path Tracer

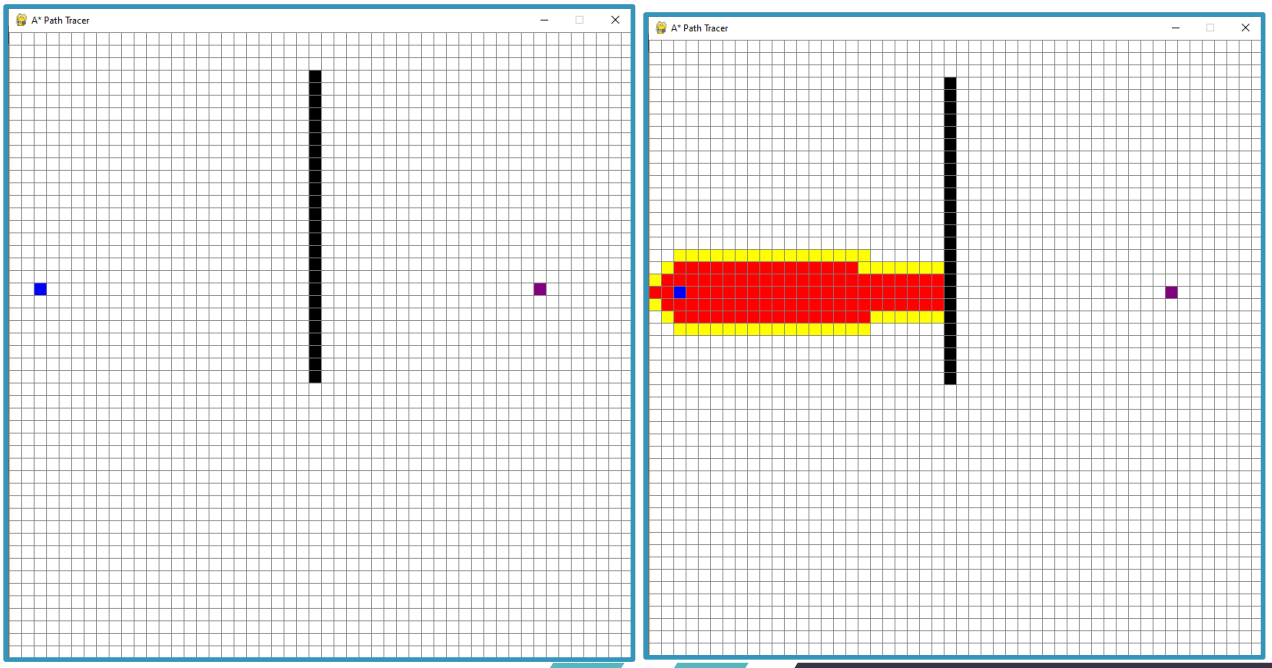
Project Overview

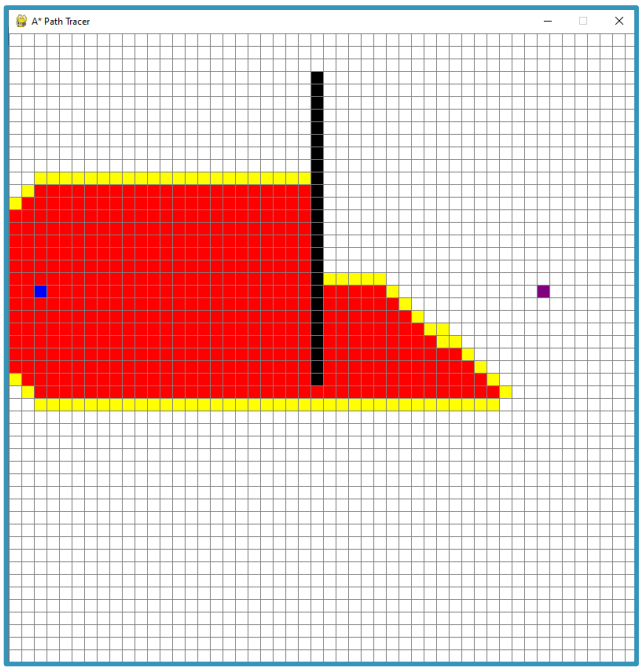
- ✓ Built a well-featured **PyGame** Visualizer to simulate the path tracing algorithm.
- ✓ Utilized & implemented an improved empirical algorithm (A* Algorithm) that outperforms the conventional Dijkstra's approach by eliminating numerous inaccurate turns.

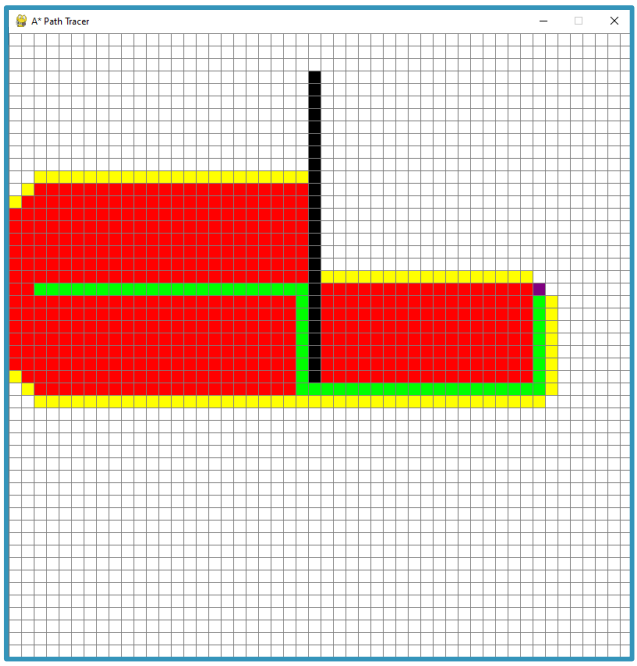
Accomplishments

- **USER INTERFACE**
  - ✓ Initially, the grid is empty, the user can choose the starting & destination point, and the barriers by using left mouse click and right mouse click is used to unselect the selected.
  - ✓ Once all are chosen, by entering the space bar, the algorithm starts executing.
  - ✓ If there exists a path between the starting & destination point, the path is highlighted.
- **RECONSTRUCTIBLE FEATURE**
  - ✓ If we want to visualize the algorithm once again, instead of opening the file again, we can just hit the space bar to visualize the algorithm.
  - ✓ We can add more barriers or change the start & endpoints and run it once again.
  - ✓ To clear the entire grid, hit the 'C' key and once again we can start from the beginning.

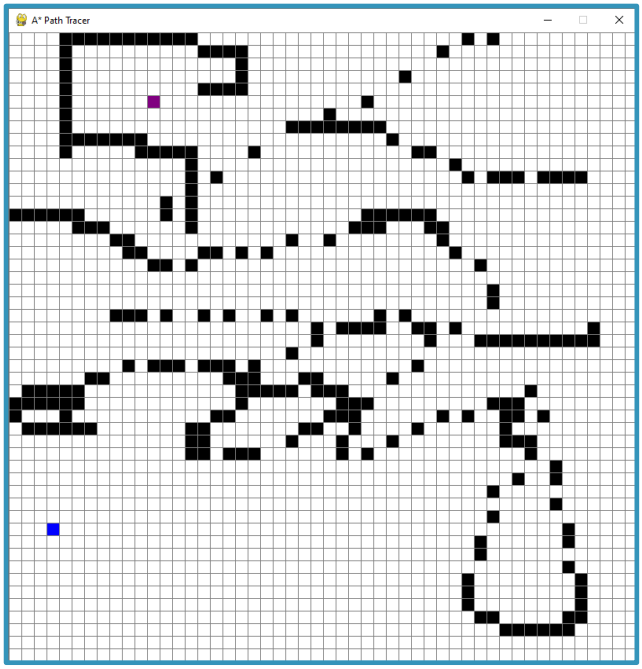
EXAMPLE 1

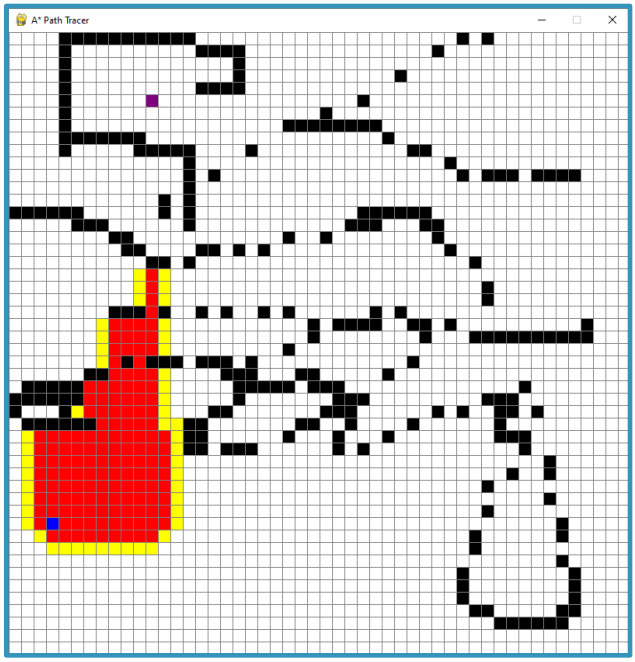


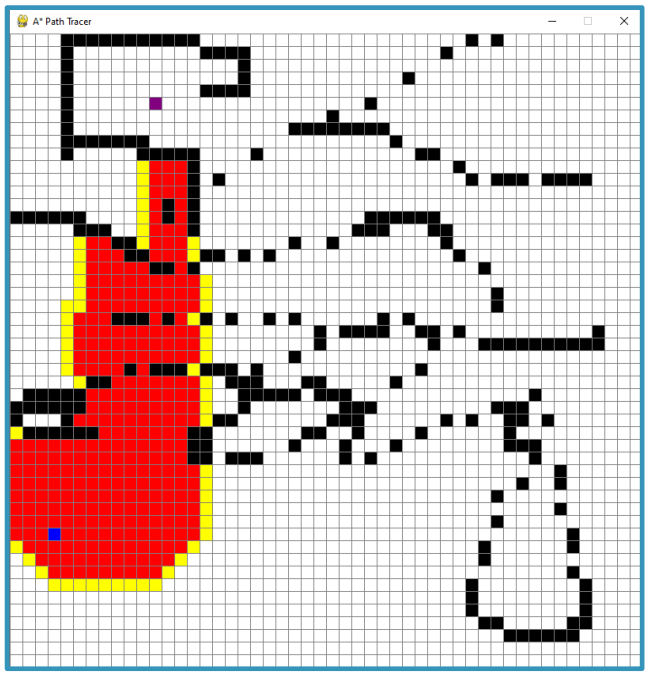


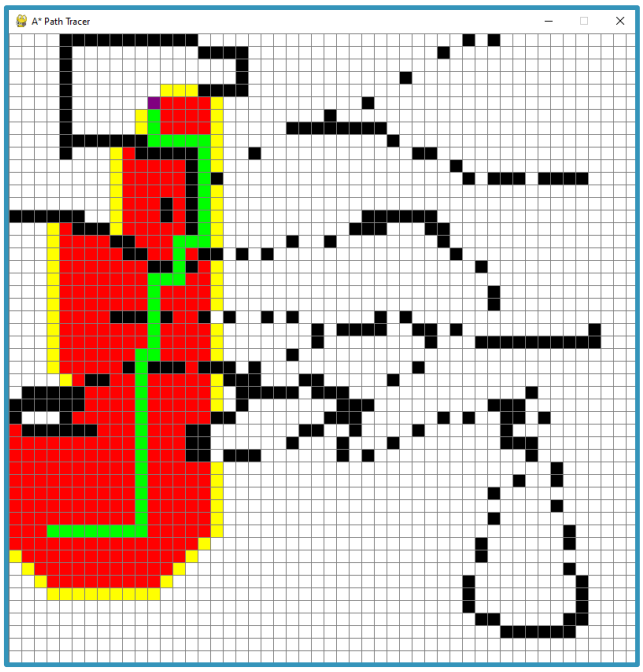


EXAMPLE 2









Observations

- Unlike Dijkstra, the A* algorithm doesn't search in all the possible directions.
- Instead, it is a directed algorithm and tries to go in the most appropriate direction.
- In example 1 shown above, the algorithm knows the destination is at the back of the barrier, so it always tries to go rightwards in this case.
- Thus, we are neglecting many misdirected paths, which may not lead us to the destination.
- A* algorithm is an empirical algorithm, which can be seen only in practice.

Conclusion

- ✓ The entire project is done in Python with the help of PyGame, for a better user interface.
- ✓ A* algorithm is implemented, and the working can be visualized, and if there exists a path from the starting & destination point, the shortest path is highlighted in green.
- ✓ Images of the project are included above for reference.