# User Guide: Pathfinding Visualizer

Overview

Welcome to the Pathfinding Visualizer! This tool allows you to explore two popular pathfinding algorithms—Breadth-First Search (BFS) and A*—on a 10x10 grid. You can set start and goal points, add obstacles, and watch the algorithms find the shortest path in real-time. This guide explains how to use the interface and its features.

Interface Layout

The visualizer window includes:

- ✓ **Grid**: A 10x10 grid where pathfinding occurs.
- ✓ **Controls**: Options below the grid to configure and run the simulation.
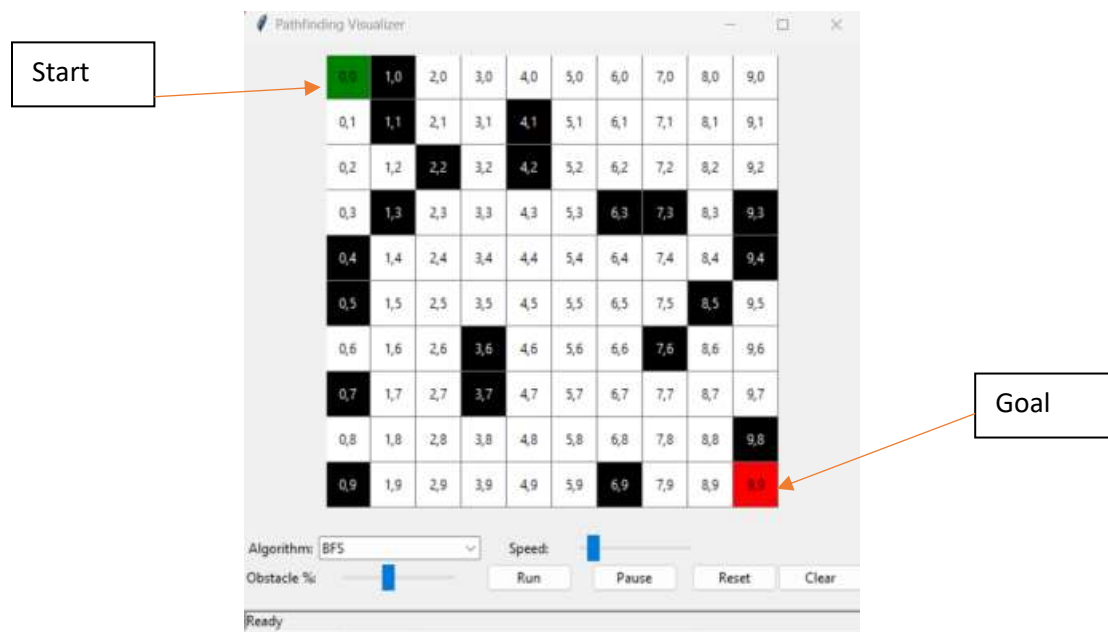- ✓ **Status Bar**: A text area at the bottom showing current actions and results.
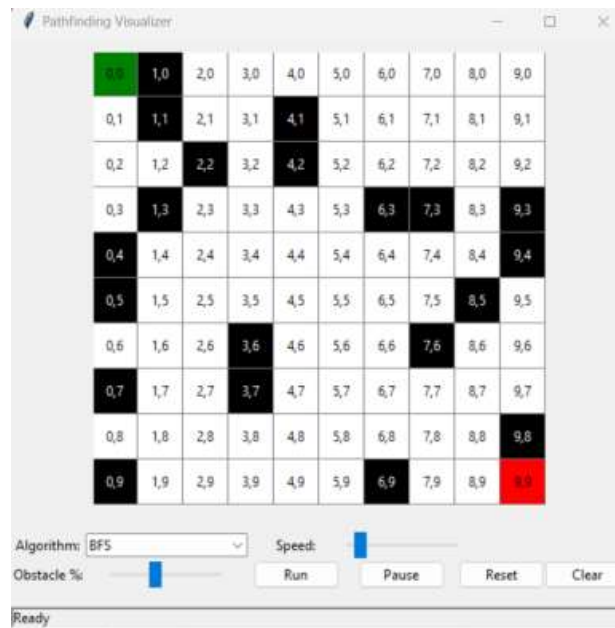
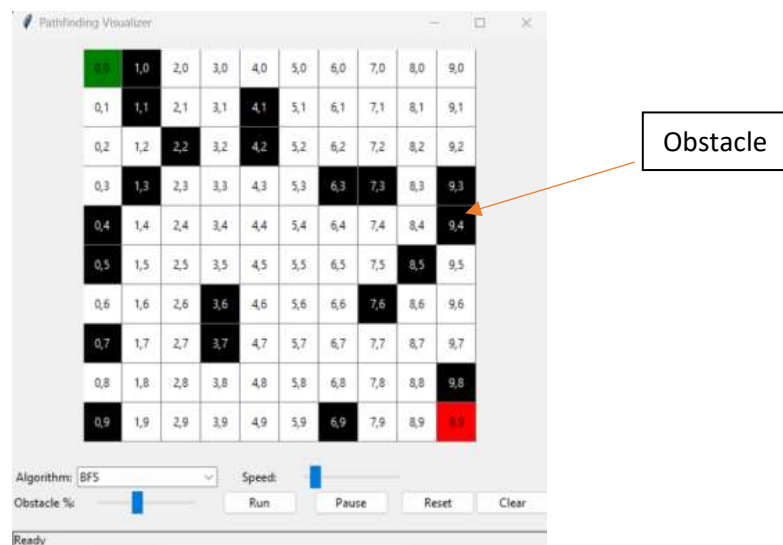*-Interface*

Using the Features

1. Modify the Grid

- **Move Start or Goal**:
    - ○ Click and hold the green (start) or red (goal) cell.
    - ○ Drag it to a new white cell and release.
    - ○ *Note*: You cannot place start or goal on obstacles.

- **Add/Remove Obstacles**:
    - ○ Click an empty (white) cell to turn it black (obstacle).
    - ○ Click a black cell to turn it white (empty).
    - ○ *Tip*: Customize the grid before running an algorithm.

2. Configure Settings
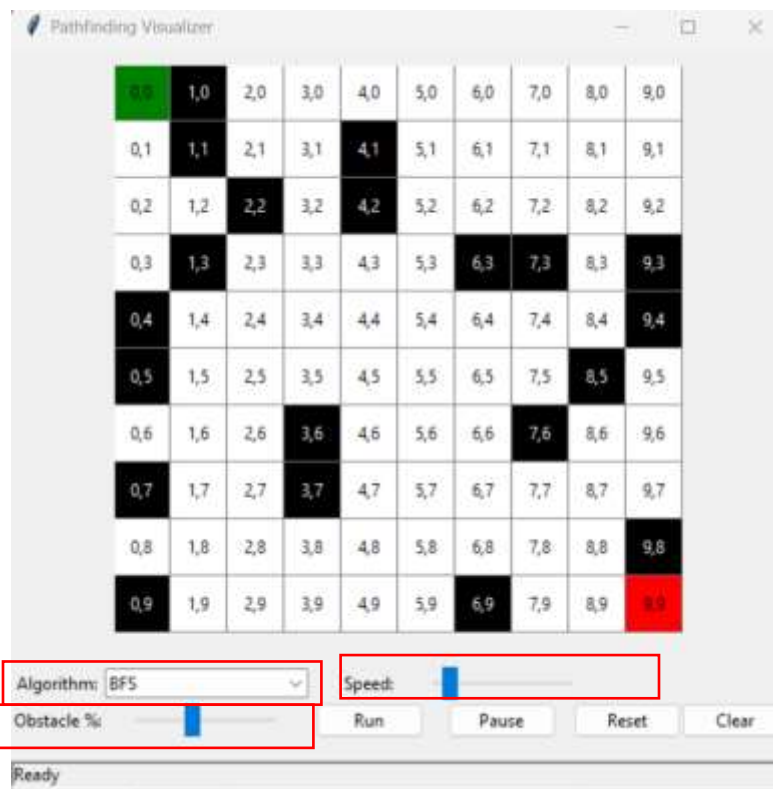
- **Algorithm Selection**:

  - ✓ In the "Algorithm" dropdown, choose "BFS" or "A*".
  - ✓ BFS explores broadly; A* uses a shortcut to the goal.

- **Visualization Speed**:

  - ✓ Adjust the "Speed" slider
 - ✓ Lower values = faster animation; higher values = slower, step-by-step view.

- **Obstacle Percentage**:
  - ✓ Move the "Obstacle %" slider to set the chance of obstacles appearing when resetting the grid.

3. Run the Simulation

- Click the **"Run"** button to start the selected algorithm.
- Watch the grid animate:

    - ✓ **Orange**: Current cell being explored.
    - ✓ **Light Blue**: Cells queued to explore (open set).
    - ✓ **Light Green**: Cells already explored (closed set).
    - ✓ **Blue**: Final path from start to goal (if found).

- The status bar updates with progress (e.g., "BFS - Exploring: (x,y)") and results (e.g., "Path found! Length: 18").
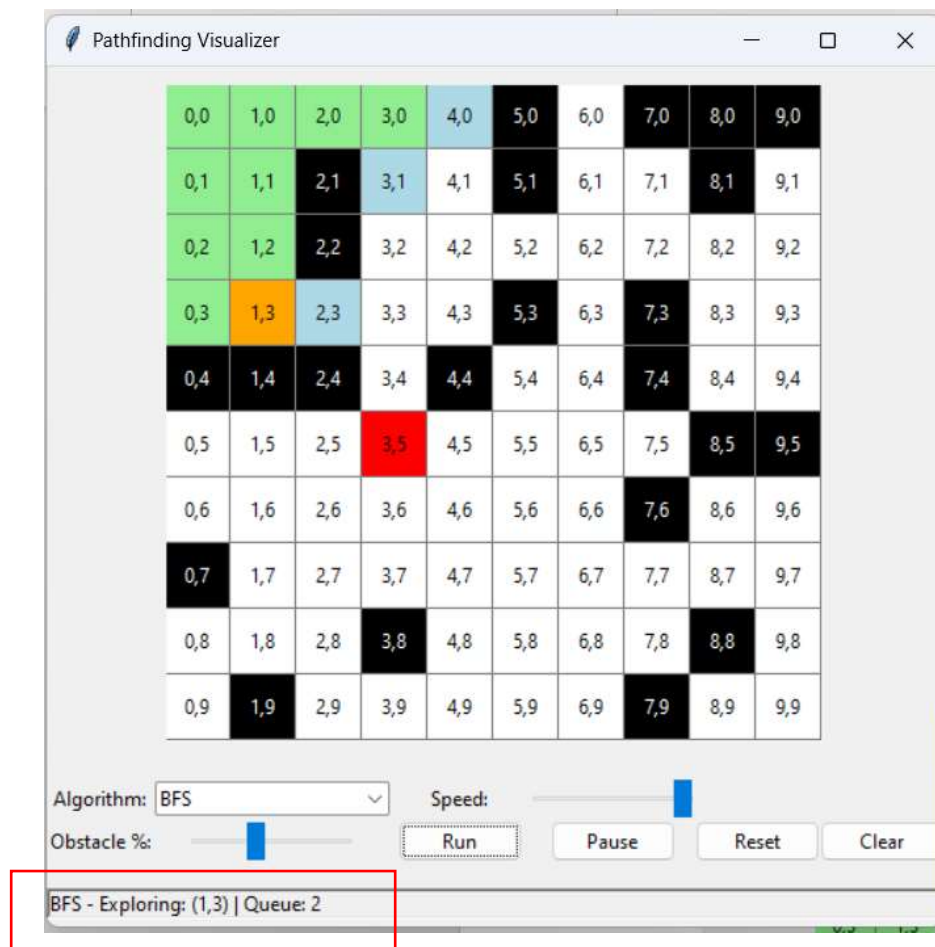
4. Control the Simulation

- **Pause**: Click "Pause" to stop the animation. Click "Run" to resume.
- **Reset**: Click "Reset" to generate a new grid with the set obstacle percentage.
- **Clear**: Click "Clear" to remove the path and exploration colors, keeping start, goal, and obstacles.
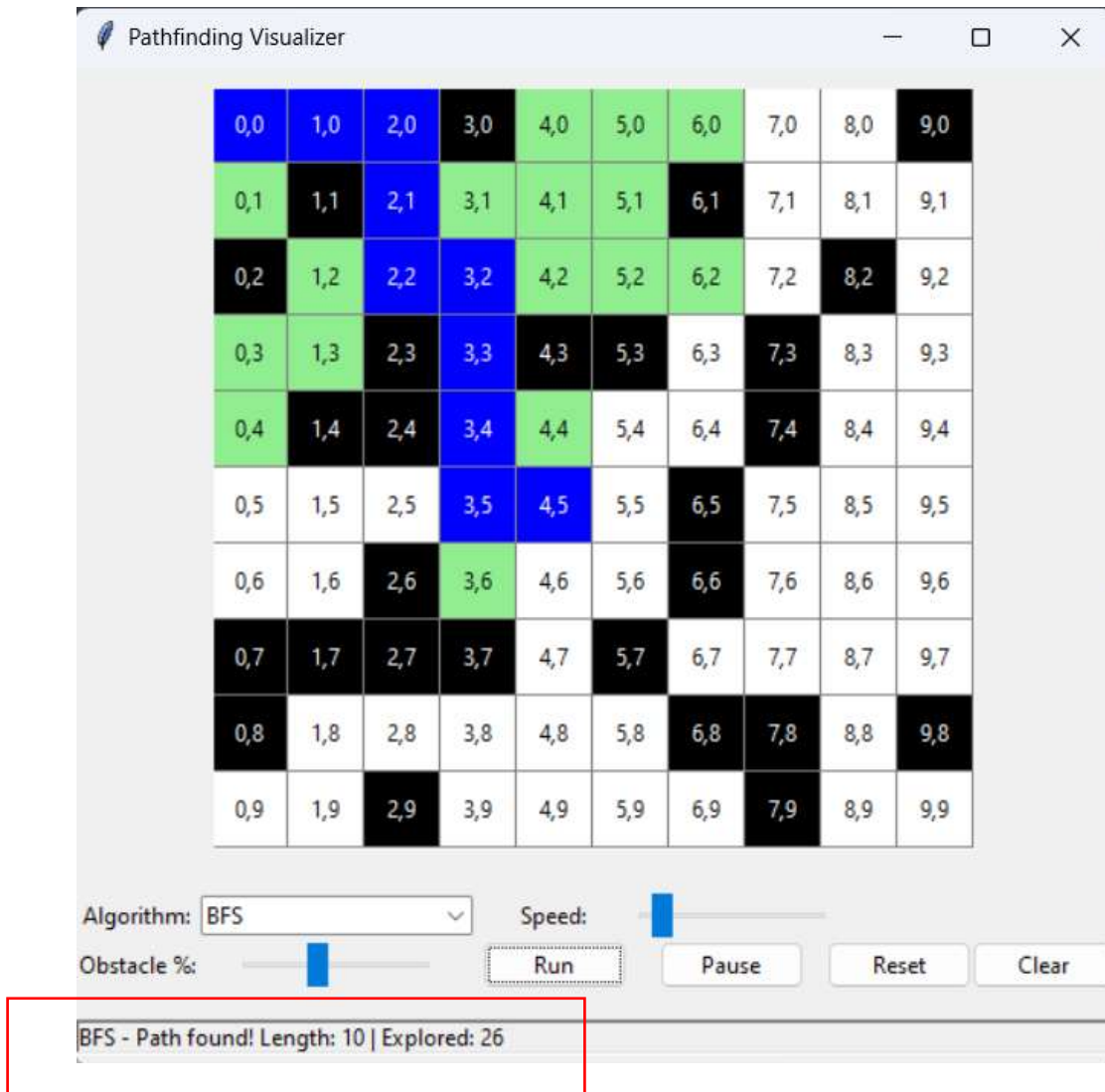
Tips and Troubleshooting

- ✓ **No Path Found?**: If the status says "No path found!", obstacles may block all routes. Clear some obstacles or reset the grid.
- ✓ **Slow Performance?**: Increase the speed slider for faster animation.
- ✓ **Stuck Animation?**: Click "Pause" and "Reset" to start over.
- ✓ **Grid Coordinates**: Each cell shows its (x,y) position (e.g., "0,0" is top-left).