Random Walk Game Documentation - User Guide

1. Introduction

The Random Walk game simulates a path taken by a "walker" who moves across a grid. The walker makes random movements based on selected directions. The grid can vary in size and can have different movement patterns (1D, 2D, and 8D). The game is designed to be highly customizable based on user input.

2. Key Features

- One-Dimensional (1D) Random Walk: The walker moves only vertically (up or down), but horizontally (left or right) is unrestricted.
- Two-Dimensional (2D) Random Walk: The walker moves both horizontally and vertically with options for either wrapping around the grid or staying within grid limits.
- Eight-Dimensional (8D) Random Walk: The walker can move in all 8 possible directions: up, down, left, right, and the four diagonals.
- Movement Control: The game offers full control over grid size, step count, and movement options.
- Wrap Option: When the wrap option is enabled, the walker will appear on the opposite side of the grid once they move out of bounds.

3. User Interface

The user interface of the Random Walk game is composed of the following components:

- Text Box for Step Count: A field where the user can input the number of steps the walker should take.
- Text Box for Grid Size: A field where the user can define the size of the grid (e.g., 50x50).

- Option Buttons for Walk Type:
  - 1D Random Walk: Select to make the walker move vertically.
  - 2D Random Walk: Select to allow both horizontal and vertical movement.
  - 8D Random Walk: Select for full movement (up, down, left, right, and diagonals).
- Check Box for Allowing Revisit: This checkbox allows the walker to revisit positions or restricts them to new positions.
- Check Box for Wrap Option: Enable the wrap feature where the walker moves from one side of the grid to the other when they exceed grid boundaries.
- Run Button: Starts the Random Walk simulation.

4. How to Use the Game

4.1 Starting the Game

1. Enter the desired number of steps in the "Steps" text box.
2. Enter the grid size in the "Grid Size" text box.
3. Choose the movement type (1D, 2D, or 8D).
4. Select whether revisiting positions is allowed and if the wrap-around option should be enabled.
5. Click the "Run" button to start the random walk.

4.2 While the Game is Running

The walker’s position will be updated on the grid after each step. A visual representation will show where the walker has moved.

- In 1D Mode, the walker moves vertically, and horizontal movement is unrestricted.
- In 2D Mode, the walker can move both vertically and horizontally.

- In 8D Mode, the walker can move in any of the 8 possible directions (up, down, left, right, and diagonal).

5. Movement Rules

- 1D Movement: The walker moves in one dimension vertically. Horizontal movement does not restrict the walker's steps.
- 2D Movement: The walker can move in both vertical and horizontal directions.
- 8D Movement: The walker can move in all 8 possible directions. This includes moving diagonally.

6. Wrap-Around Feature

If the wrap-around option is enabled, when the walker exceeds the grid boundaries, they will appear on the opposite side of the grid.

- Horizontal Wrap: If the walker moves off the right edge, they will appear on the left. Similarly, if they move off the left, they will appear on the right.
- Vertical Wrap: If the walker moves off the bottom, they will appear at the top. If they move off the top, they will appear at the bottom.

7. Grid Size Limitations

The size of the grid is constrained by the Grid Size input from the user. The grid size can be any value, but excessively large grid sizes (over 500x500) may cause performance issues.

8. Scenarios & Results

- Movement Boundaries: If the wrap-around is disabled, the walker will remain inside the grid boundaries. They will not be allowed to move beyond the top, bottom, left, or right edges.

- Walker’s Path: The game will track the walker’s path by marking each step they take on the grid.

- Step Count: The walker will stop once the specified number of steps is reached.

9. Troubleshooting

Issue 1: "Grid is not updating correctly"

- Cause: The grid cells are not refreshing to display new positions.

- Solution: Ensure that the DoEvents function is correctly placed in the code to update the interface during each step of the walk.

Issue 2: "Out of Bounds Error"

- Cause: The walker moves out of bounds and the grid size limit is not respected.

- Solution: Double-check the wrap option setting and ensure it’s properly managed within the RandomWalk subroutine.

Issue 3: "Performance Slowdown on Large Grid Sizes"

- Cause: Extremely large grid sizes may slow down performance.

- Solution: Consider using smaller grid sizes for better performance.

10. Future Enhancements

1. Multi-Grid Size Support: Ability to adjust grid size dynamically during the walk.

2. Visual Improvements: Enhanced display features to provide better feedback on walker’s movements.

3. Track Walker’s History: Record and display the walker’s previous positions to allow users to view the entire path taken.

11. Detailed Code Breakdown

Code Snippets for Movement Logic:

1. Random Direction Selection:

```
direction = Int(Rnd * 2) + 1
If direction = 1 Then
    currentRow = currentRow + 1 ' Move vertically down
Else
    currentRow = currentRow - 1 ' Move vertically up
End If
```

2. Handling Vertical Wrap:

```
If wrapOption Then
    If currentRow < 1 Then currentRow = gridSize ' Wrap to the bottom row
    If currentRow > gridSize Then currentRow = 1 ' Wrap to the top row
Else
    If currentRow < 1 Then currentRow = 1 ' Stay at top
    If currentRow > gridSize Then currentRow = gridSize ' Stay at bottom
End If
```

3. 2D and 8D Movement:

```
Select Case direction
    Case 1: currentRow = currentRow - 1 ' Move up
```

```
        Case 2: currentRow = currentRow + 1 ' Move down
        Case 3: currentCol = currentCol - 1 ' Move left
        Case 4: currentCol = currentCol + 1 ' Move right
    End Select
```

Sample Score Calculation:

```
Score = (WordLength * 10) + (LivesLeft * 5) - (WrongGuesses * 2)
```

12. Conclusion

The Random Walk game offers a flexible and engaging simulation of random movements across a grid. Whether you want to test simple vertical movements, full 2D movement, or complex 8D movements, the game can be tailored to any preference. It’s easy to adjust, simple to use, and offers plenty of room for future improvements.