Project Report:

2048 Console Game in C

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1. Title of the Project 2048 Console Game Using C Language and Array-Based Data Structures

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2. Introduction

The 2048 game is a sliding tile puzzle game that has gained popularity due to its simplicity and engaging logic. The game board is a 4x4 grid where tiles with numbers combine when moved in the same direction. The goal is to create a tile with the number 2048. This project implements the 2048 game in C using 2D arrays and fundamental programming concepts.

This project helps reinforce array manipulation, conditional logic, loops, and user interaction handling in C. It's a practical application of data structures at the foundational level.

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3. Objective

- Implement a fully functional 2048 game in C.
- Strengthen understanding of 2D arrays and data movement.
- Handle dynamic gameplay logic using only core C features.
- Create an interactive and engaging console-based game experience.

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4. Tools and Technologies Used

Tool	Description
C Programming	Language used for logic and structure
GCC Compiler	To compile and execute the C program
OnlineGDB / Turbo C / Code::Blocks	IDEs used for writing/testing
Console Window	For input and display of game board

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5. Project Description

The project involves the following features and logic:

- **Board Representation:**
  A 4x4 matrix (int board[4][4]) is used to represent the game state.
- **Initialization:**
  The game starts with two random tiles (2 or 4) on the board.
- **User Input:**
  Players input commands (w, a, s, d) to move tiles up, left, down, or right.
- **Movement Logic:**
  Each movement slides tiles and merges same-valued adjacent tiles.
- **New Tile Addition:**
  After a valid move, a new tile (2 or 4) is added randomly.
- **Win Condition:**
  When a tile reaches 2048, the player wins.
- **Game Over Check:**
  If no move is possible and the board is full, the game ends.

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6. Code Structure and Functions

The implementation is modularized into functions for clarity:

- initializeBoard() – Initializes the board with two random tiles.
- printBoard() – Displays the current state of the board.
- addRandomTile() – Adds a 2 or 4 in an empty position.
- moveTiles(char direction) – Controls direction-specific movement.
- slideLeft(), slideRight(), slideUp(), slideDown() – Define the logic of moving and merging tiles.
- checkWin() – Checks for 2048 tile.
- checkGameOver() – Checks if there are no more valid moves.

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7. Sample Output (Screenshot)

2048 Game:

. . 2 .

. 4 2 .

. . . .

2 2 . .

Enter move (w: up, s: down, a: left, d: right): a

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8. Challenges Faced

- Implementing correct merging logic without merging multiple times in one move.
- Managing random tile placement after each valid move.
- Preventing unnecessary tile shifts when the move doesn't affect the board.
- Keeping track of win and game-over conditions efficiently.

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9. Learning Outcomes

- Learned how to manipulate 2D arrays in real-time game environments.
- Gained experience in organizing a C program using multiple functions.
- Understood how to apply loops, conditionals, and input/output in a game scenario.
- Improved logical thinking through movement and merging logic.

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10. Conclusion

The 2048 console game project was a valuable learning experience in using C to build real-world logic-driven applications. The project highlighted the importance of arrays, modular code, and careful control of user interaction. It also showed how simple data structures like arrays can form the backbone of interactive games.

This project helped strengthen fundamental programming concepts while also being engaging and enjoyable to implement.
