Technical Description of FPGA-Based Flappy Bird Game

Introduction:

The following document provides a technical description of a game resembling "Flappy Bird" designed to run on Field Programmable Gate Arrays (FPGAs) using Hardware Description Language (HDL). It outlines key components, functionality, and mechanisms utilized within the game.

Game Components:

1. Pseudo-Random Number Generation:
   - Pseudo-random numbers are generated using a Linear Feedback Shift Register (LFSR) algorithm.
   - These numbers serve as the basis for generating pseudo-random pipes represented by red pixels within the game environment.

2. Game Elements:
   - Bird: Represented by green pixels, the bird is controlled by pressing and un-pressing keys.
   - Pipes: Generated pseudo-randomly based on LFSR-generated numbers, pipes serve as obstacles within the game environment.

3. Gameplay Mechanics:
   - Bird Control: Players control the bird's vertical movement by pressing and un-pressing keys. Additionally, a constant downward force is applied to the bird.
   - Scoring: A counter tracks the player's score, incremented only when the bird successfully passes through a pipe.
   - Game Over: The game resets if the bird flies out of bounds or collides with a pipe.

Technical Details:

1. Pseudo-Random Number Generation:
   - LFSR is implemented to generate pseudo-random numbers efficiently.
   - These numbers determine the generation and placement of pipes within the game environment.

2. Hardware Description Language (HDL):
   - The game logic and functionality are implemented using HDL, which enables hardware-level description and synthesis of the game components onto FPGAs.
   - HDL facilitates efficient utilization of FPGA resources and enables real-time interaction with game elements.

3. Game State Management:
   - Game state, including bird position, pipe placement, and score, is managed and updated in real-time within the FPGA.
   - Collision detection algorithms ensure accurate detection of collisions between the bird and pipes.

Conclusion:

The FPGA-based Flappy Bird game leverages HDL and LFSR-based pseudo-random number generation to create an immersive gaming experience. By employing hardware-level descriptions and optimizations, the game achieves efficient resource utilization and real-time gameplay responsiveness.