

Gomoku Game (Five in a Row)- Project Proposal

Team Members

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Description

The core of this project is to design and implement an 80's style video Gomoku game. *Gomoku*, also called Five in a Row, is a strategy board game. Players take turns to place a stone of their color on an empty intersection on the board, which is 15 x 15 in size. The winner is the first player to form an unbroken line of five stones of their color horizontally, vertically, or diagonally.

This game will offer both a two-players mode and a player-vs-AI mode, allowing players to compete against each other or against an AI opponent.

Software Design & Hardware Integration

The FPGA will serve as the core for rendering the game board and pieces, as well as processing user inputs. The software component will be responsible for the game logic, including move validation, managing player turns, and checking for win conditions. A key feature will be the mechanism for determining the winner based on the horizontal, vertical, or diagonal alignment of five pieces. Additionally, we will design and implement algorithms for the AI mode to enable player-vs-AI gameplay.

Visual Presentation & GUI

To meet the visual needs of our game, the frame buffer will support at least 2 bits per pixel, allowing for at least four colors. This will enable us to use green for the board background, and black and white for the game pieces, along with potentially another color to highlight winning sequences or for UI elements.

Refresh Rate and Display

A refresh rate of 30 frames per second will be sufficient for the simplicity of the game's graphics and interactions. The display resolution will use the VGA standard minimum of

640×480 pixels, but we may increase the resolution depending on the memory limitations of the FPGA used.

User Interface

The game will be controlled through simple input devices, such as a USB keyboard or gamepad, for navigating menus, moving pieces, and making moves.

Major Tasks

1. Hardware design for rendering the game board and pieces on the FPGA.
2. Software development for the basic game logic, the player vs player mode and the player vs AI mode. AI algorithms will be based on Decision Tree, which is a common practice in Gomoku AI development. Neural networks are also to be considered, depending on our progress.
3. Integration of hardware and software to ensure a smooth gameplay experience, user input processing, and visual display at the desired refresh rate.
4. User interface design for game control and navigation, utilizing simple input mechanisms compatible with the FPGA board.
5. Testing and optimization to ensure reliable performance, including gameplay testing and hardware-software integration testing.

Milestone

1. Basic game logic development will take about 1 to 2 weeks.
2. Understanding Gomoku AI algorithms, adding AI features to the game will take about 3 weeks.
3. Integrating everything to hardware will take about 1 to 2 weeks.
4. Testing, debugging will take about 1 to 2 weeks.