

4840 project proposal (Chess game)

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Introduction:

This proposal outlines the development of an interactive chess game designed for implementation on the DE1-SoC FPGA board. It supports multiple modes: Player vs. Player, Player vs. AI, and a replay feature to review previous games step-by-step. USB controllers or keyboards will provide intuitive input, while a clear GUI displayed via VGA will visualize the chessboard, pieces, and moves. Immersive sound effects will enhance user interaction. The system will strictly enforce standard chess rules, including Castling, Pawn Promotion, and En Passant Capture, and features adjustable timers to simulate professional matches. Comprehensive logs will be generated for replay and analysis.



Figure 1: chessboard (source: <https://www.chess.com/learn-how-to-play-chess>)

Key Features:

1. I/O: The program will be executed in the de1-soc FPGA board. It uses 1-2 USB controllers or keyboards as input. The output contains video and sound. Simple GUI of the chessboard and some menu will be displayed with the VGA port. Some sound effects will be used for operations like start, move, and pause.
2. The program will be developed with a complete rule check system for the chess game, including special rules like Castling, Pawn Promotion, En Passant Capture. Similar to other chess games, two internal timers will be used for black and white. Users could set up the total time of the game before starting.
3. For each game, a txt log file will be generated. The log file will record each step of movement that the black and white made. Eg: Black: a2a4 White: a7a6.
4. We plan to develop different game modes:
 - a. Player vs. Player: two players play chess against each other. They will use USB controllers in order to move.
 - b. Player vs. Computer: we plan to develop a simple AI for the computer mode. A single player could play chess with the AI as PvE mode.
 - c. Chess game replay: by choosing the log file, user could replay a game by choosing "next step", "previous step", or "auto-play" to watch a exist chess game.

Technology Stack:

Hardware: DE1-SoC FPGA board, USB controller or keyboard for input, VGA monitor and 3.5 mm speaker for output.

Software: SystemVerilog for FPGA and driver, Python or C for game and GUI

AI Engine: Basic chess AI implemented in Python or C

Milestone:

1. Write a chess program with basic chess functions. This might be pure terminal based for debugging purposes.
2. Developing drivers for hardware IO.
3. Developing GUI for the chess program.