

Handheld Connect 4 Video Game – Arduino-Based

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Project Description:

The Arduino-Based Handheld Connect 4 Game will allow the user to enjoy a portable game of Connect 4. The objective of this game is to create a string of 4 of your pieces (diagonally, vertically, or horizontally) while blocking the opponent (the CPU) from achieving this. The game will be displayed on a color LCD with a D-pad for navigating board columns/the menu and a select button to drop a chip/choose a menu option.

Prototype Plan:

An evolutionary prototype for this Handheld Connect 4 Game will be created; it will constantly be refined programmatically and on the breadboard until the final product is synthesized. This type of prototype would be more suitable for our group, as the project possesses a high ceiling, and there is a potential for additional features potential to be added. Therefore, by having a functioning model of the final project at hand, we will be able to augment the design, re-code and re-test accordingly.

Major Software Components:

- Implement a user interface using an LCD display
 - Will possess a start-up menu including difficulty levels, game instructions, play and quit button
- Recursion-based Artificial Intelligence
 - Game-state depths vary depending on difficulty level selected by the user
- Implement a sound library to provide audio feedback
 - When pieces reach the bottom, when the user switches rows, victory/defeat background music
- Display the complex object of a Connect 4 board with moving pieces
 - Tracking and maintaining game state

Hardware:

- Arduino DUE (x1)
- 1.8 Inch TFT 128x160 Color LCD (x1)
- 2X Power Magnifier for Smart Phone Screen (x1)
- Push Buttons (x5)
- 15mm 8Ω MiniSpeaker (x1)
- 9V Battery and Power Supply (x1)
- SPST On/Off Switch (x1)
- 10kΩ Potentiometer Volume Control (x1)

Anticipated Challenges:

Some of the major obstacles that we will likely encounter include:

- Optimizing the AI: Since this LCD has a relatively high resolution (and the most powerful Arduino it is compatible with is the DUE with 96KB of SRAM), limiting the number of calculations needed per turn will ensure an optimal refresh rate and overall game smoothness (this will be achieved by implementing Alpha-Beta Pruning)
- Successfully Displaying the Graphics: The Connect 4 board is a complex object and will need to be fine-tuned in order to optimize its appearance given the resolution and size of the LCD
- Combining software and hardware components: Our group's past technical experience is mainly concentrated in software, so learning how to physically construct a device that can execute the intended functions we programmed will prove to be challenging