Objective:
We had an initial interest to create a digital game on the Motorola 68hc11. This handheld digital version of the board game can be played with or without an opponent. This game will lead to an endless amount of fun at home or on the go.

Theory of Operations:
HARDWARE THEORY: This project required minor hardware configuration because of the LED matrix used for our game display. An external battery and 5V regulator are used in order to supply sufficient power to the LED matrix. We also decided to use the LCD screen to display instructions for the game and the winner. Finally, two push buttons are used to read the input of the game player. The LED Matrix communicates using the SPI protocol which had to be configured using the SPCR. It communicates to Port D of the 68hc11.

SOFTWARE THEORY: The software is based on subroutines. The following subroutines were needed for the game:
- USERPIK: Subroutine for user to pick column
- YES/NO: Subroutine to determine if user would like to play again
- IDISP: Subroutine to display user or AI selections on LED matrix
- LDMATRIX: Subroutine which loads the three matrices - red, green, and entire board
- LDFLASH: Adds flash dropping code to LDMATRIX subroutine
- CLMATRIX: Subroutine to clear what was previously loaded
- CHECKR: Subroutine to check for a winner
- PICK: Subroutine to pick column for AI to drop piece.
- LCD Display subroutines

Design Alternatives:
Before finding the LED matrix, our group had considered other alternatives for the display of this game. We had first considered playing the game on an LCD screen. We were unable to find an LCD big enough for this purpose so we turned to the second alternative. The second option was to build a display using two individual LEDs for each location in the game matrix. This option would have required an intense hardware configuration. We were not pleased with this option so we searched for another alternative. We had also considered using a keypad for selecting the column to enter the LEDs.

Key Points for Selecting Your Design:
We came across the LED matrix from Sparkfun.com. This was ideal for this project because it minimized the hardware for the game and it used the SPI interface which is available on the Motorola 68hc11 microcontroller.

We determined that using the push buttons would make the game easier to play and also simplify the hardware rather than using a keypad for the user interface.

Constraints from Regulating Bodies on the Project:
• Parts designed to enclose and protect other equipment should have mechanical strength and durability.
• Electric equipment shall be installed in a neat and workmanlike manner.
• Electric equipment shall be firmly secured to the surface on which it is mounted.
• Electric equipment shall be free from recognized hazards that are likely to cause death or serious physical harm.

Related Patents:
1. --US Patent 5893798 - Hand-held electronic game devices
2. --US Patent 6983935 - Gaming device having an interactive matrix game
3. --U.S. Patent 7331857 - This is a patent of a "Gaming system

References:
1. -- Connect 4 is a Trademark of Milton Bradley, 1974