LCD Memory Game

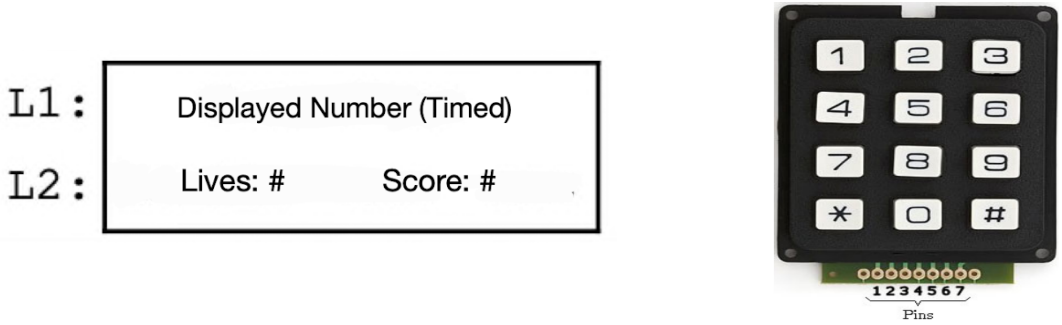

Figure 1 - shows the display screen user keypad for the LCD Memory Game.

Game Instructions: Connect the device to a 5V voltage source. Click the New Game button (* key on the keypad) to start the game. The LCD Memory Game will initially display a 4-digit number for 2 seconds, and then prompt the user to utilize the 4x3 keypad to punch in the number that was displayed. If the user guesses the number correctly, their score increases by 1, the buzzer will play a note and the amount of time that the number will be displayed will decrease by 0.1 seconds, making the game more difficult. When a wrong digit is keyed in, the buzzer will sound and the player will lose one of their lives. After 5 correct guesses, the number displayed will increase to a 5-digit number. The game will end when the player runs out of lives or presses the Reset/New Game (* key on the keypad) button. The shortest display of time for the numbers is 0.5s.

Target Specifications

- The first line of the LCD will display the randomized 4 or 5 digit number, the second line of the LCD will display the user's score as well as the number of lives they have
- The timing of the 4 and 5-digit number displayed is regulated using the help of a timer and an internal oscillator. The timing is subject to decrease every time the user gets a question correct. This is regulated based on the user's score (the higher the score, the shorter the amount of the time number is displayed)
- The timing of the number displayed is directly related to the player's score. At the start of the game when the player's score is 0, the amount of time the number is displayed is 2 seconds. The amount of time will decrease by 0.1 seconds with every increase in the score by 1.
- The buzzer will sound at a certain frequency when a wrong digit is keyed in and a different frequency when the user guesses the entire number correctly.
- An interrupt is utilized as well as a push button switch as the New Game/Reset button

Operating Conditions

- Operating Voltage: 3.0 - 5.5 [V]
- Output High voltage, All output pins: 4.2V – 5.5V
- Output Low voltage, All output pins: 0V – 0.9V
- Input High-voltage (Depending on Vcc) : All inputs:

- Operating Temperature: 0℃ to 50℃
- Storage Temperature: -20℃ to 60℃

Input/Output: The user input/output corresponds to the external keypad and LCD screen . Figure 1.1 shows pins 1-7 of the 3x4 keypad. Pins 2,4,6 & 7 are input pins (rows) while pins 1,3 & 5 are output pins (columns). The keypad acts as the super input while the LCD screen outputs the players lives and score.

Uncertainty

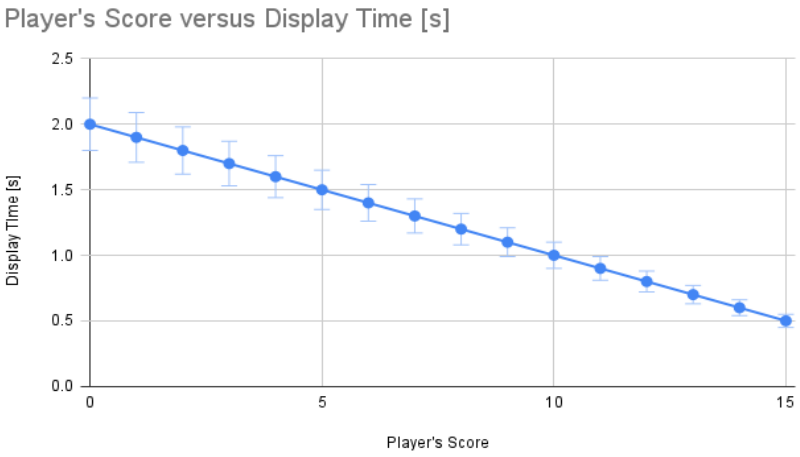

Figure 2: Display Time versus Player's Score, with the bars on the data points showing uncertainty

Initial Testing Results : From the initial testing, only the firmware in regards to the timing of the number display and the introduction of the increase from 4 to 5 digits was changed.

Initially, the amount of time the 4-digit number was displayed at the start was 3 seconds and the time decreased by 0.25 seconds each time the player guessed a number correctly. 3 seconds was determined to be too long for the number to be displayed and the decrement of 0.25 seconds was too drastic. It was opted to start at 2 seconds and decrease time by 0.1 seconds each time the player guessed the number correctly. This allowed for the game to be fair and the score to more accurately represent the player's memory.

To make the game more interesting and engaging, a test was done where after certain attempts, the number of digits displayed increased to 5 from 4. This allowed for a further increase in difficulty on top of the shorter time that the number would be displayed.

Initially, the buzzer would only sound when the player guessed a digit incorrectly. Testing the game interface repeatedly, a suggestion was made to make the game more interactive and provide more feedback to the player. The buzzer would now make a sound, at a different frequency when the player guessed the full 4 or 5 digit number correctly.