**GLCD Animation – Project Proposal**  **Debbie Santana – 4507468**

**Proposal**

The project consists of a graphical animation in an DMD screen display using the Hitachi HD44780 controller [1] in the Explorer 16/32 Development board. The device will show custom characters created in C language under the use of the Arduino IDE (or the MPLABX 6.0 with its compiler XC16) and the LiquidCrystal library [2]. The board has buttons that will be programmed to modify the animation; this animation consists of a fish in the sea, using four buttons its position will change and the speed as well.

**Algorithm**

The HD44780 controller will be used to perform the transfer of data from the code in C and the Display.

A screenshot of a computer

Description automatically generated

*Illustration from Advanced Digital Systems: Experiments and Concepts with CPLDs, 1E. (pg.246) [3]*

1. 8-bit “ASCII” data code is written to the DMD data bus.
2. DMD uses that code to look up the pixel data for the character in the Character Generator ROM (CGROM).
3. DMD transfers the pixel data from CGROM to the Display Data Ram (DDRAM).
4. Content of DDRAM is displayed on the DMD.

Depending on the velocity of the transfer rate, if the PPS rate is slow, then each character will slowly appear.

The DMD data includes *clear display*, *cursor on/off, display on/off, character position*, and a *shift display* as basic commands to position or configure the display (like configuration options for a game). So, creating a custom character can be done by the Character Generator RAM; each of this use an identification label and their pixel data as to be transferred to the CGRAM.

An illustration of this:

A screenshot of a computer

Description automatically generated

*Illustration from Advanced Digital Systems: Experiments and Concepts with CPLDs, 1E. (pg.252) [3]*

Here we can clearly see the identification of the address in the CGRAM and how it can create and store the custom character.

**Hardware**

The next picture shows the layout of the HD44780 LCD Display and its pin out.

A screenshot of a computer

Description automatically generated

*Illustration from Advanced Digital Systems: Experiments and Concepts with CPLDs, 1E. (pg.245) [3]*

* Power Supply: Ground (0)
* Power Supply: 5V (1)
* Contrast Adjustment Input: 0 volts = dark characters, 5 volts = light characters
* Register Select: 1= display data, 0 = command
* Read/Write input = 1 = reads Busy Flag, 0 = write command or display data
* Enable input: Negative edge triggered clock input.
* 8-bit Data Bus: Data0 – Data7

This LCD is in the Microchip Explorer 16/32 Development kit board that the college provides, and micro-USB-to-USB-A cable is required to power the board.

**User interface**

Dedicated I/O lines on the PIC board are allocated for other functionalities, the use of two buttons placed for user interaction and even diagnostic purposes. User will dynamically adjust the animation speed (either for speeding the animation or slowing it down) and changed the position in which the character will move. Animation is in B/W colors.

**References**

[1] Wikipedia, “Hitachi HD44780 LCD controller”.

Downloaded from <https://en.wikipedia.org/wiki/Hitachi_HD44780_LCD_controller>

[2] Arduino, “LiquidCrystal – LiquidCrystal()”.

Downloaded from <https://www.arduino.cc/reference/en/libraries/liquidcrystal/liquidcrystal/>

[3] Delmar Learning & Cengage Learning, “Advanced Digital Systems: Experiments and Concepts with CPLDs”, 1E.