California State University, Long Beach

CECS 447

Project 4

Rodrigo Becerril Ferreyra
Student ID 017584071

A project that demonstrates the ST7735 Color LCD.

04 December 2021

1   Introduction

The purpose of this project is to demonstrate some of the capabilities of the ST7735 Color LCD. The display is 128x160 square pixels, and is capable of displaying 16-bit color (16 bits total divided among the three color channels). For the project, my objectives were to create a scene that includes all of the following:

- a background with two different colors.

- a circle, a vertical line, a horizontal line, and a diagonal line.

- a moving object.

- at least one line of text with different sizes and different colors.

My theme is based on the video game series *Portal*, in which the player uses a "portal gun" in order to create portals to teleport around the "test areas" and solve puzzles. If the player places a portal on the ceiling, and the complementary portal on the floor just below, the player's character will fall through the portal on the floor and come out from the portal on the ceiling. This will repeat indefinitely (as long as the player doesn't move), and the player's character will continue to speed up until reaching terminal velocity. An example of this behavior can be found here (image Copyright (C) Valve, used under fair use for education): https://i.kym-cdn.com/photos/images/original/000/192/001/tumblr_lt2crpCRxY1r2yv3qo1_500.gif.

2   Operation

The program works by using the provided Adafruit libraries to interface with the ST7735 LCD. It calls several functions, mostly ST7735_DrawCircle() and ST7735_DrawLine(); this is because these are used for drawing the stick figure.

The program animates the stick figure by repeatedly drawing it in white, waiting a while, then drawing it again in black. Because the color of the background is also black, this creates the illusion of the stick figure being erased or deleted. The delay is implemented using the SysTick hardware timer.

A video of the embedded system in operation can be found here: https://youtu.be/8JxxkUPIeaU.

3   Theory

There is not much theory to this project; it is simply utilizing the Adafruit libraries to create an animation.

4 Hardware Design

Figure 1 shows the connections for my specific version of the ST7735 LCD. Note that there are more pins that are not shown; any pin not shown is not connected (floating).
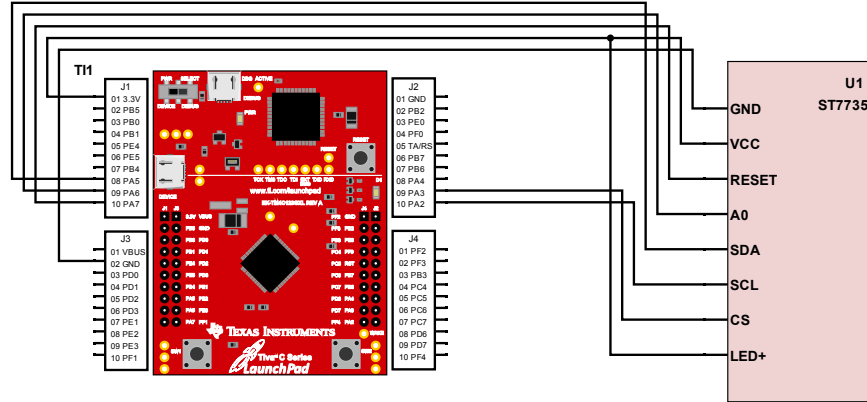

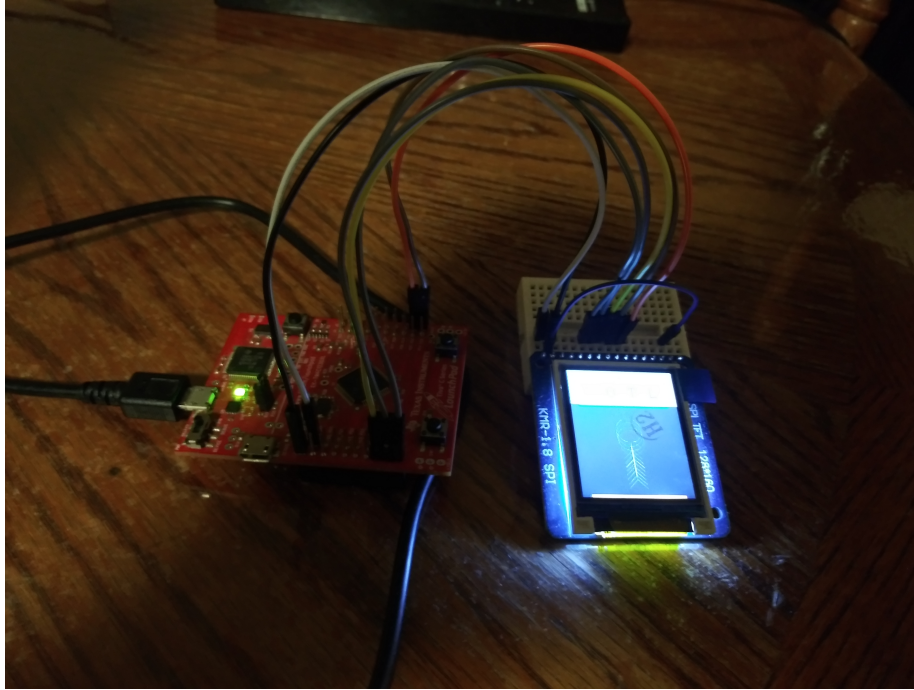Figure 1: The pin connections for my version of the ST7735 LCD.

Figure 2: An image of the embedded system in action.

5   Software Design

Most of the work was already done for us courtesy of Adafruit, as we are using their libraries to communicate to the LCD. My contribution was simply the `main()` function. The following is a breakdown of what the `main()` function does:

1. First, the program draws the background. It consists of a mostly black screen. There is a white section on the top, which is where all of the text goes.

2. Next, the program draws the text. First, some simple text with a size of 1 is drawn in black using the function `ST7735_DrawString()`. Next, some more advanced text in different size and colors is drawn by invoking the `ST7735_DrawCharS()` function in a `for` loop.

3. Finally, the program enters an infinite loop. This loop repeatedly draws and erases a stick figure in various positions on the screen in order to simulate falling.

The main challenge I faced while writing the program is sometimes having to draw the stick figure in parts, for example having its head on the ground but

its body on the ceiling. This made it much harder to use a function for drawing the person like in the example given to us. It definitely is not impossible, but for a project of this scale, I don't think it was necessary.

After every iteration of the stick figure is drawn, the same exact commands are used to erase the figure. This is done by drawing the figure in black instead of white.

6   Conclusion

This project was relatively simple compared to some previous projects. All that was really required was some creativity and knowing how to use the library that was given to us. Overall, this project was quite enjoyable and informative.