**EGR326 PreLab6 F21**

Using LCD Graphics Display Interfaced To The MSP432 SPI Communications Port

An LCD module that has the flexibility to create images (limited to 128 columns x 160 rows of pixels) provides an attractive option for user display. You have a color graphics LCD in your lab/project kit (be careful as the screen was designed for 3.3 V and the IC inputs can be damaged by 5V signals).

This week you will learn how to control it from the MSP432. Before lab you will need to understand how the graphics controller chip works and write C function calls to test and use this module for embedded system information display.

To prepare for this week’s lab:

1. Start with the package located in your lab/project kit containing a ST7735 color graphic display module with connector pins. You may want to also solder the header pins to the connector on the edge of the Launchpad to make those MSP432 pins available as connections.

B**e very careful** with this operation since **you can damage the board traces if they become overheated.**

1. **Do not wire it to 5V power and logic signals.** The MSP432 will only generate 3.3 V I/O signals given it is powered from a 3.3V source on the Launchpad. Be sure to study the schematic diagram in the Launchpad User’s Guide document so you understand what you’re doing.
2. Download and study the datasheet for the ST7735 IC that controls the display and interfaces with the SPI bus (a copy can be found in the Data Sheets folder in Course Documents).
3. Describe the features of the control module and how it is used to draw text and bit mapped graphics using a program running on the microcontroller.
4. Include a schematic diagram showing all wired connections between the MSP432 and the display in your notebook. Be sure to include pin numbers.
5. You will be writing C code to communicate with the ST7735 IC using the SPI protocol and a couple of extra control signals. The MSP432 hardware I/O port in SPI mode handles the fairly complex bus control necessary to establish communication between the microcontroller and display. Review the assigned readings on the SPI communication protocol and the MSP432 technical reference section on SPI.
6. There is a comprehensive library and MSP432 interface code that has been provided on-line by Prof. Jim Valvano at Univ. of Texas. Download his archive of projects for the MSP432 Launchpad (ValvanoWare) and study the ST7735\_MSP432 project at <http://users.ece.utexas.edu/~valvano/arm/downloadmsp432.html> . You may adapt his code, however, **you must provide attribution** to all code that is not yours (in the headers and comments, identify the source of your code). Also, **you must understand in detail how the code works** (expect to be tested on this with questions in lab, and the next exam).
7. The CCS project organization has changed since this ST7735\_MSP432 project was written. You’ll need to start a new project and import the display library files ST7735.c and ST7735.h (written by Limor Fried at AdaFruit, modified by Valvano) from Blackboard. These files are modified versions from the download archive. These ST7735 library files are the keys to using the graphics display effectively.

Study the SPI configuration in commonInit() and basic SPI interface commands writecommand() and writedata() as discussed in lecture. Then get familiar with the various graphics utility functions.

Provide answers to the following questions in your notebook:

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1. What is the name and function of each of the four signals that implement the SPI interface and what pins are connected to the MSP432 eUSCI module? Are all four SPI signals used in the example code?
2. In the example code: What is the SPI data rate set up in the MCU? Is the eUSCI configured to use interrupts? What is the format for sending bytes to the display controller?

This LCD will be a major component of your term project design.