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Prelab2

EGR 436/EGR 536 PreLab2
A Color LCD Graphics Display Interfaced With The MSP432 SPI Communications Port

Deliverables:

1. Pin Connection Sketch:

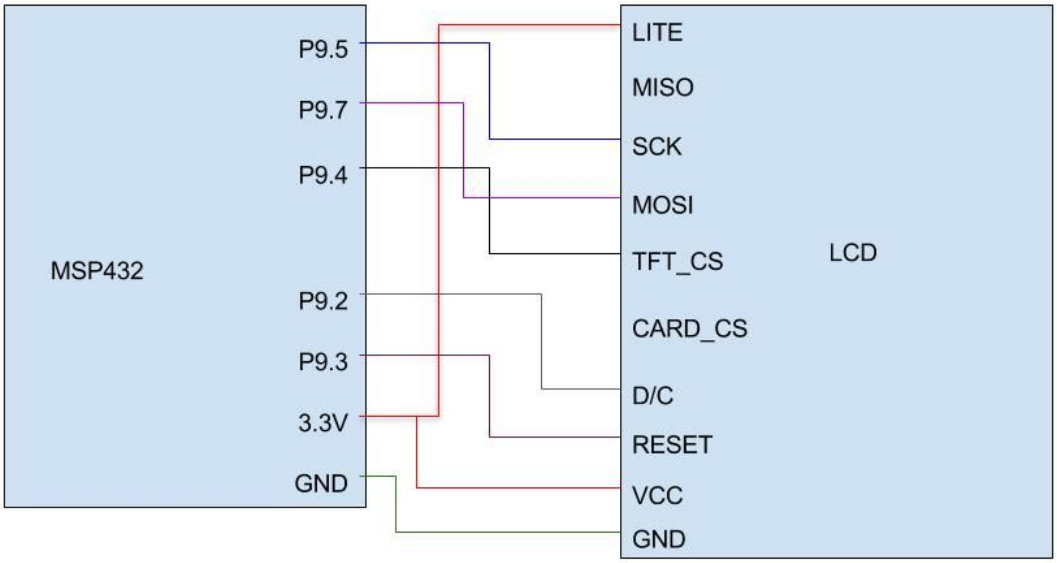


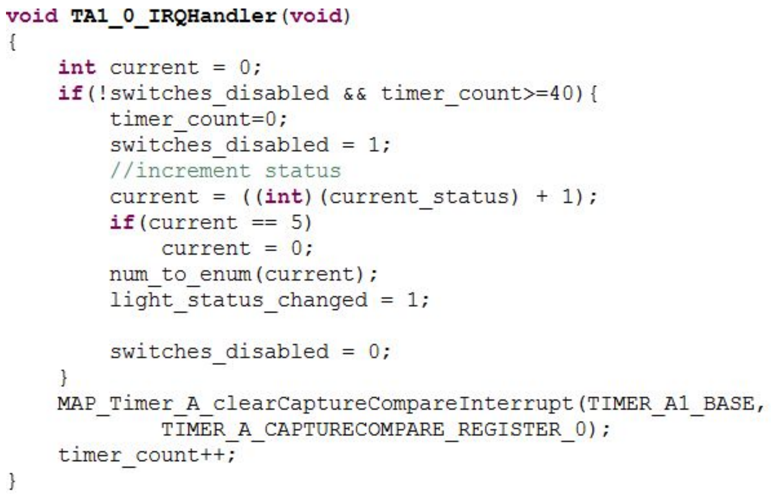
Figure 1: MSP432 Connections to LCD

2. PreLab Questions:
    1. Describe the name and function of the signals that the MSP432 eUSCI module uses to implement the SPI interface. Are all four signals used in the example code? Why or why not?
        a. The four signals used by the eUSCI module to implement the SPI interface are as follows: UCxSTE, UCxSIMO, UCxCLK, and UCxSOMI. In the case of the example code, eUSCI module A3 is used so the x is replaced with A3. UCxSTE is used as the chip select signal. The UCxSIMO signal is the master to slave communication line. In instances were such communication is necessary, the UCxSOMI signal is used for slave to master communication. The last signal, UCxCLK is the clock signal. The only signal that is not used in the example code is the UCxSOMI signal because the slave does not send data back to the MPS432.
    2. In the example code, what is the SPI data rate? Is the eUSCI configured to use interrupts? What is the clock polarity and phase expected by the ST7735 controller?

   a. In the example code, the SPI module is configured to send data using a 4MHz clock signal. During configuration, interrupts are disabled for the SPI module. The ST7735 controller expects the clock polarity to be set such that CLK is held low when inactive. As for the clock phase, data shifts in on first edge and out on the following edge.

3. How is a pixel on the screen represented in the bitmap array for your image?
   a. The bitmap arrays, created by the BmpConverter file, represent the each pixel on the screen as a 16 bit hex value.

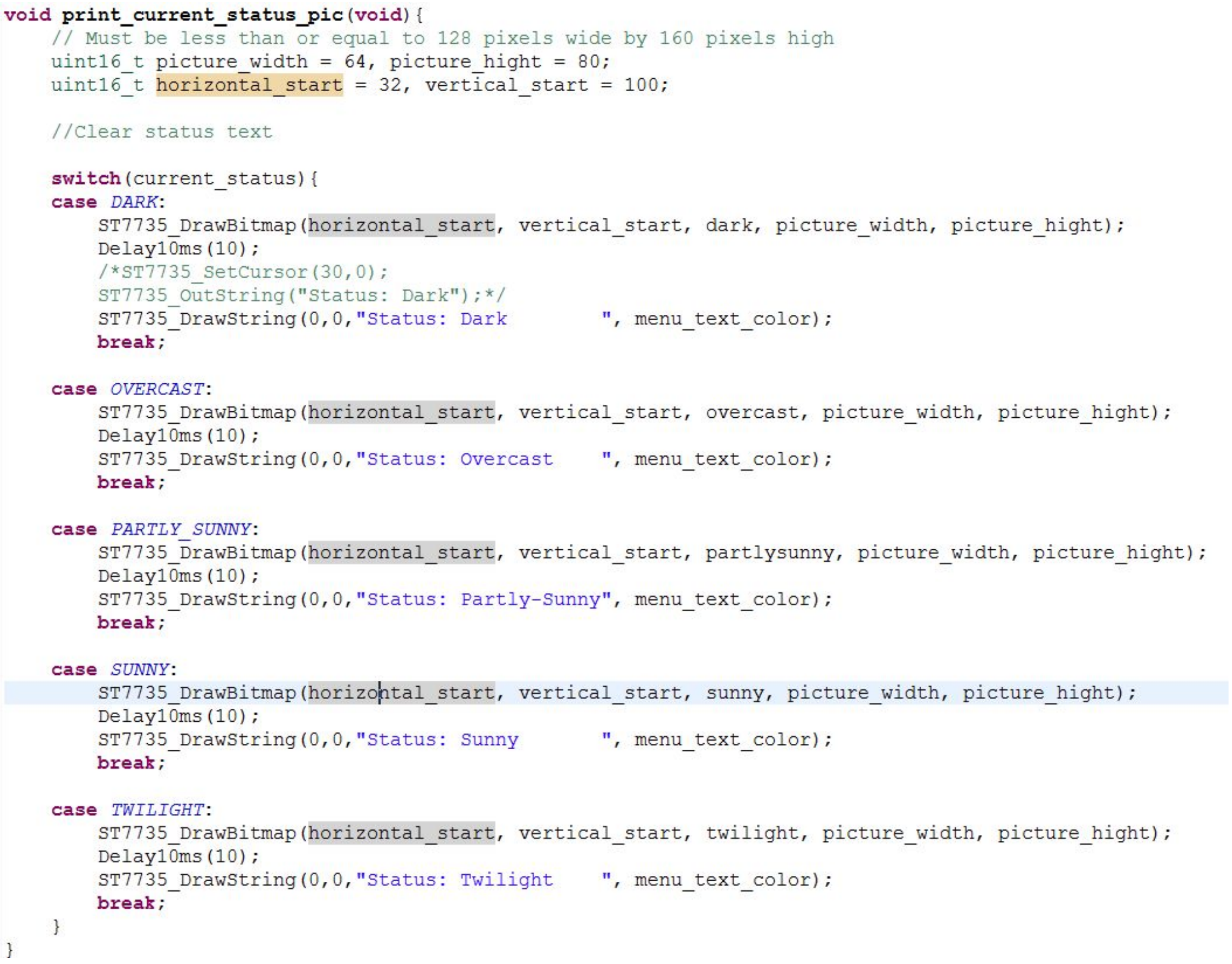
4. Copy and paste a “code snippet” showing the lines of code that will display your light level images.
   a. To display the light images timer A is used to create 3 second increments. The interrupt handler shown in Figure 2 fires each time timer A overflows. When 3 seconds have passed, the interrupt sets the flag, light_status_changed. A while loop within main checks this flag on each pass. Once this flag has been set, the print function shown in Figure 3 will display the current light status image.



```
void TA1_0_IRQHandler(void)
{
    int current = 0;
    if(!switches_disabled && timer_count>=40){
        timer_count=0;
        switches_disabled = 1;
        //increment status
        current = ((int)(current_status) + 1);
        if(current == 5)
            current = 0;
        num_to_enum(current);
        light_status_changed = 1;

        switches_disabled = 0;
    }
    MAP_Timer_A_clearCaptureCompareInterrupt(TIMER_A1_BASE,
            TIMER_A_CAPTURECOMPARE_REGISTER_0);
    timer_count++;
}
```

Figure 2: Timer A Interrupt Handler



```
void print_current_status_pic(void){
    // Must be less than or equal to 128 pixels wide by 160 pixels high
    uint16_t picture_width = 64, picture_hight = 80;
    uint16_t horizontal_start = 32, vertical_start = 100;

    //Clear status text

    switch(current_status){
    case DARK:
        ST7735_DrawBitmap(horizontal_start, vertical_start, dark, picture_width, picture_hight);
        Delay10ms(10);
        /*ST7735_SetCursor(30,0);
        ST7735_OutString("Status: Dark");*/
        ST7735_DrawString(0,0,"Status: Dark        ", menu_text_color);
        break;

    case OVERCAST:
        ST7735_DrawBitmap(horizontal_start, vertical_start, overcast, picture_width, picture_hight);
        Delay10ms(10);
        ST7735_DrawString(0,0,"Status: Overcast    ", menu_text_color);
        break;

    case PARTLY_SUNNY:
        ST7735_DrawBitmap(horizontal_start, vertical_start, partlysunny, picture_width, picture_hight);
        Delay10ms(10);
        ST7735_DrawString(0,0,"Status: Partly-Sunny", menu_text_color);
        break;

    case SUNNY:
        ST7735_DrawBitmap(horizontal_start, vertical_start, sunny, picture_width, picture_hight);
        Delay10ms(10);
        ST7735_DrawString(0,0,"Status: Sunny       ", menu_text_color);
        break;

    case TWILIGHT:
        ST7735_DrawBitmap(horizontal_start, vertical_start, twilight, picture_width, picture_hight);
        Delay10ms(10);
        ST7735_DrawString(0,0,"Status: Twilight    ", menu_text_color);
        break;
    }
}
```

Figure 3: Print Function