

CPE 325: Embedded Systems Laboratory

Laboratory Assignment #9

Assignment

[100 pts]

You are given a program for the MSP430F2013 microcontroller in a binary form (source code is not available to you). This program will blink an LED at a specified frequency, which is controlled via the SPI interface. The program works as follows:

- LED3 blinks at a frequency of $(0.25 \text{ Hz} * \text{multiplier})$. The initial multiplier value is 4 (initial frequency of 1 Hz).
- The multiplier can be set by sending a number between 1 and 20 to the '2013 microcontroller using SPI.
- When the program receives 0 via SPI, LED3 will be continuously on (no blinking).
- When the program receives 255 via SPI, it replies with the current value of the multiplier.
- The program ignores all other numbers received through SPI.

Load that program to MSP430F2013 and do the following assignment:

1. Write a C program for MSP430FG4618 that asks the user to enter the multiplier value in Putty/MobaXterm via UART at a baud rate of 57,600.

When a number from **1** to **20** is entered, the program converts the entered string to an integer value (you can use `atoi` function for this) and sends this value to MSP430F2013 via SPI to blink the LED.

If the user enters **'0'**, your program should send 0 to the MSP430F2013.

If the user enters **'?'** instead of a number, your program should send 255 to the MSP430F2013 and read the response (saved multiplier value). Display the received value in Putty/MobaXterm on a new line starting with: **"The stored multiplier value is:"**

If an invalid input is entered, the program prints **"Invalid multiplier entered"**

2. Implement your own version of the program for MSP430F2013 in C with the same functionality. You can start with this part and not use the given program if you want.

Hints:

- You can reuse the functions that you made in the previous lab for UART communication as well as functions `SpiGetState` and `SpiSetState` from demo code. Make sure to use the correct value for the dummy write in `SpiGetState`.
- You can use the Watchdog Timer of MSP430F2013 in the same way as you did with MSP430FG4618. Do not use ACLK: this clock source is not available in this microcontroller. Make sure to choose a small enough interval that round-off error does not noticeably affect your output frequency.

Bonus

[10 pts]

1. **Bonus 5 points** will be given to students who demonstrate their assignment by establishing Bluetooth connection between MSP430FG4618 and PC rather than using RS-232 connection.
2. **Bonus 5 points** will be given to students who use DMA to copy data to the transmission buffer for UART communication instead of using a loop.

Topics for Theory

1. SPI vs UART
2. DMA controller

Deliverables

1. Source files (C files)
2. Screenshots of terminal output