EEE 404/591: REAL-TIME DSP

Lab 3 Report

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INTRODUCTION:

This lab introduced us to special on-chip peripherals available in DSP 56858 Freescale chip and the methods to memory map them to registers. It dealt especially with Interrupt Service Routines, how to program them, and how to use them for finding instruction counts. External and internal interrupts were covered. It also covered methods to configure various registers for different purposes.

RESULTS AND ANALYSIS:

Analysis and comments on questions in manual:

1. *Why is the forcing operator ">>" used? (Hint: Check Tables 3-11 to 3-14 in [3])*

'>>' is used as an assembler forcing operator. These are used in instruction to force a desired addressing mode. It indicates long address or data.

2. *Why is the "bfset" instruction used? What is IPR6? (Hint: refer to Chapter 8 in [1] to answer these questions).*

'bfset' sets a one to the pins selected by the operand. IPR6 is interrupt priority register 6. It is one of the 9 interrupt priority registers available on the chip, which has the information of priority levels for each interrupt.

3. Timer period calculation:

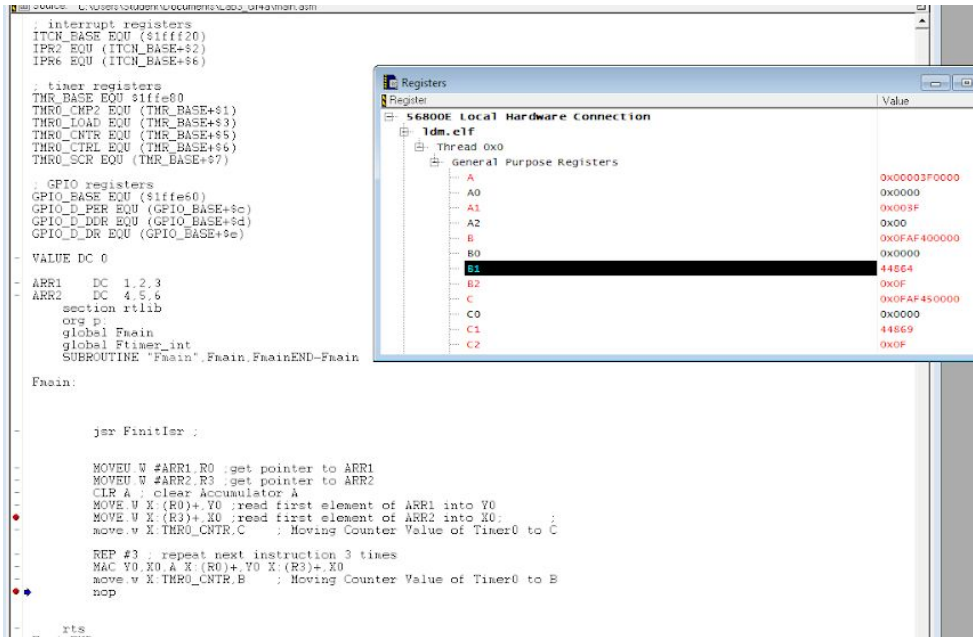
er value	alue loaded into counter	calculated between LED toggles	sum of on and off time)
$\frac{2.097*1\,M}{65535} = 31.9 \approx 32$		$\frac{4 \cdot 194}{2} = 2.097$	econds
	$\frac{1\,M*0.5}{16} = 31250$	$\frac{1}{2} = 0.5$	nd
	$\frac{1\,M*3}{64} = 46875$	$\frac{6}{2} = 3$	nds

Formula used:

$$\frac{instruction\ count * scale\ factor}{clock\ frequency} = time\ between\ toggle$$

For the third case a scaling factor was chosen such that the counter value was not more than the maximum possible in the frescale chip.

4. *Using the memory-mapped registers of the timer described in Chapter 13 of the DSP5685x 16- Bit Digital Signal Processor User's Manual, use the timer to measure the number of cycles that are consumed by a function that will multiply and accumulate the following two vectors: a={1,2,3} and b={4,5,6}*



TMR0_CNTR value before MAC operation = 44869
TMR0_CNTR value after MAC operation = 44864
So, the instruction count = 44869 – 44864 = 5
Since, the DSP chip runs at a frequency of 2MHz while the timer runs at 1 MHz, the total instruction count=10

Added functionalities:

To find the number of instructions cycles taken for the execution of any instruction, TMR0_CNTR value before the instruction and after can be stored in a register. The difference between the 2 values will give the cycles taken for the execution of the code. TMR0_CTRL register can be used to change the scaling factor for clock speed. Bits 9 to 12 stores the primary count source, which stores the scale factor. Interrupt priority register controls the priority level for any interrupt service routine defined. The first 2 bits controls the IRQA priority level and the next two bits controls the IRQB priority levels.

LAB EVALUATION:

There wasn't any difficulties specific to this lab that were encountered during the lab hours. Some questions in prelab quiz were misleading.

CONCLUSION:

From this lab, we got to practice programming Interrupts in Freescale DSP chip. We got to learn about the different on chip peripherals available and on how to assign values to various registers which control different functionalities. Each of the registers have a specific binary value for each functionality. Using the timer control register, the current timer value can be known, which gives an idea on the number of instructions executed from the beginning or since the timer was initiated. We used ISR to control the LED blinking in different configurations by changing the scale factor.
What we liked the most was the ample amount of time that we got this time to finish the lab work.