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445L Lab 1 Write-up

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Objectives

The objective of this lab is to introduce the lab equipment, familiarize yourself with Metrowerks CodeWarrior for the 9S12, and to develop a set of useful fixed-point output routines.

Software Design

Main calls fixed.c functions, fixed.c functions call printf, printf calls TERMIO_putchar, TERMIO_putchar calls LCD_outchar which sends data to the hardware LCD.

Hardware Design

On next page.

Analysis and Discussion

1) In what way is it good design that there is no arrow directly from the fixed.c module to the LCD.c module in the call graph for your system?

It is good design because it makes fixed.c machine-independent. As long as fixed.c uses printf, it can be reused for other pieces of hardware that can display strings.

2) Why is it important for the decimal point to be in the exact same physical position independent of the number being displayed?

The output to the LCD looks nice and the resolution of the software will be consistent.

3) When should you use fixed-point over floating point? When should you use floating-point over fixed-point?

Use fixed-point over floating point when speed is a factor. Floating point calculations, without hardware support, can cost many cycles. If precision is required and speed is not necessarily a factor, floating-point is better.

4) When should you use binary fixed-point over decimal fixed-point? When should you use decimal fixed-point over binary fixed-point?

Binary fixed-point can be used for increases in speed because the bitshifts to rescale the number are faster than normal multiplication. Decimal fixed-point is preferable when exact powers of 10 are needed.

5) Give an example application (not mentioned in this lab assignment) for fixed-point. Describe the problem, and choose an appropriate fixed-point format. (no software implementation required).

A coin counter. The counter will display the current amount of change in a jar. The counter increases when more change is added. Since the resolution of the counter only needs to be .01, the change can be internally represented as an integer value that is multiplied by .01 before being displayed.

6) Can we use floating point on the 9S12? If so, what is the cost?

Floating point is available only through software. The compiler adds many lines of code in order to perform floating point operations.

Extra credit) Is fixed-point or floating-point arithmetic faster on the Pentium w/MMX?

Floating point.