ME 305 Mechatronics
Department of Mechanical Engineering
Cal Poly
Spring Quarter - 2022

Lab 3: Addition of Keypad and LCD I/O to Cooperative Multi-Tasking LED Blinker

The goal of this lab is to add input-output capability, typically called I/O, to your LED blinker. More specifically, you will augment your Lab 2 code such that the user can enter on the keypad a decimal integer representing the number of milliseconds in the period for LED pair_1 and a second decimal integer representing the number of milliseconds in the period for the LED pair_2. Magnitudes from 1 to 65,535 should be accepted. The same pins should control the LEDs as in Lab 2. You have three weeks in the lab to work on this laboratory assignment, with working code and a written report due at the beginning of lab the following week. That is, your report is due at the beginning of lab on 05/12/2022.

Your program should continually check for the F1 or F2 key having been pressed. The F1 and F2 keys should correspond to LED pair_1 and LED pair_2, respectively. In response to the F1 or F2 key having been pressed, your program should take the following actions:

1. Turn OFF both LEDs in the appropriate LED pair.

2. Display an appropriate prompt on the LCD, such as, "ENTER the number of msec for LED pair 1:".

3. Accept characters representing decimal digits from the keypad.

4. Ignore all characters except 0 - 9, <Backspace>, and <Enter>.

5. Echo valid digits to the LCD and store them as ASCII characters in a buffer.

6. Handle <Backspace> appropriately.

7. The number entered by the user will be terminated by the <Enter> key. Upon receiving a valid <Enter>, your program should convert the ASCII characters to a BCD number, then convert that BCD number to a binary number, and begin blinking the appropriate LED pair at the rate associated with the period entered.

8. Error conditions, such as no digits, zero is an inappropriate magnitude, and magnitude too large should be handled properly, which includes the display of an appropriate error message. User friendliness is a required feature for your program.

9. Any time an LED pair is blinking, the period for that LED pair should be visible on the LCD, and the corresponding period should be blank if either LED pair is not blinking.

Note: In the spirit of cooperative multitasking, none of your I/O tasks should block the timely execution of other tasks. For example, when you print a prompt or error message to the LCD, these messages should be printed one character at a time, that is, each call to your display task should print no more than one character before returning so that other tasks may run. This one character per-pass-through-main limitation also applies to handling the <Backspace> command.

Week 1:   Break this daunting lab into smaller sections. Begin by ignoring cooperative

multitasking, and just write small independent programs to do the following:

- display a message to the LCD

- read a number from the keypad and display different messages based on the
    number read

- read a sequence of digits from the keypad and store them in a buffer

- conversion of several digits from ASCII to BCD and BCD to binary/hex

Week 2:   Complete the full conceptual design of your program, but continue to develop

functionality from the bottom up. Note that all of your code will need to be

implemented with adherence to cooperative multitasking. If your program is

functioning properly, the I/O associated with entering a new period for one LED

pair should not appreciably affect the rate at which the other pair is blinking.

Week 3:   Finish your program, and write up your report!