

MCSL Lab09

LCD and DS18B20

0310004

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1. Purpose

- Understand the usage of the LCD module.
- Understand the usage of the DS18B20 digital thermometer.

2. Steps

2.1 Electronic marquee

[main-1.c](#)

[LCD.c](#)

2.2 Display custom fonts and string text, switching with user button

[main-2.c](#)

2.3 Electronic marquee and digital thermometer

[main-3.c](#)

[ds18b20.c](#)

[onewire.c](#)

3. Results and Analysis

3.1 Electronic marquee

The LCD module needs 14 pins to drive and it needs two more, A and K, if the back light function is used. So the first thing to do is to initialize the GPIO pins for the module in the LCD.c, and then do some initialization stuff like turning on display, wiping the LCD screen, and reset the DD RAM address, etc. There is another function implemented in the LCD.c, LCD_write, which is used to write one instruction or data into the LCD module. The LCM timing diagram may look complicated, but it is rather simple in fact. First reset the R/W pin of the

LCM, set the RS pin according to the parameter (0 for instruction, 1 for data). Then signal the pins from D0 to D7, and finally set pin E high for a while and low for a while.

After the implementation of the LCD_write function, we only have to configure the SysTick timer and its corresponding interrupt handler to print out the team number in the LCD display for each 0.3 second.

3.2 Display custom fonts and string text, switching with user button

The first part of this exercise is very much similar to the previous one, except that it shows the custom fonts, rather than the usual letters. The only thing that we have to do is to add a function for creating fonts before the first usage. Hence, I wrote the create_font function, which loads the two fonts into the first 16 bytes of the CG RAM when the program begins, and right after the LCD being initialized.

When the user presses the button and releases, the change of modes will be triggered. However, writing strings to the LCD is also quite simple, since the most of the characters are already right in the position as their ASCII code number, so we can just write one byte into the LCM for each SysTick interrupt occurs, and wipe out the screen when the whole message is printed out and start over.

3.3 Electronic marquee and digital thermometer

I think the implementation of the one-wire protocol may be the most difficult part of this lab, since it is almost impossible to use a debugger such as GDB to debug, because the time duration will get messed up. After plenty hours of try-and-error, I finally figured it out that the problem was not the code that I wrote. It was that I had to connect the DQ pin of the DS18B20 thermometer to the Vcc with a resistor. I should have read the specification more carefully.

4. Reviews and Applications

I love the LCD module with the back light function, which really helps a lot when coding and testing in the dark night without bright lights. The thermometer is also quite useful. Though a little bit hard to configure, the one-pin design is great to devices with less ports, especially to devices that have already connected to lots of pins of LCD module.