

CPE 329: Hello World

Project 1 **LCD Display Interface using GPIOs**

Learning Objectives

1. Learn how to use the micro-controller to drive an LCD module
2. Understand how timing works on a microcontroller using software delays (busy-loops)
3. Use GPIOs for a push-button interface and LEDs

Introduction and Overview

You are to interface an 2-line, 16 character LCD screen with a parallel interface to your microcontroller using GPIO pins. In the process of this lab, you will learn how to use the GPIO pins of the microcontroller to drive external signals, and how to control the timing of those pins using software busy-loops.

System Requirements

LCD Screen requirements:

1. Your LCD screen must have at least 2 lines of display, and 16 characters per line.
2. The resolution of each character must be at least 5 dots wide and 10 dots tall.
3. Your LCD screen must have at least an 8b parallel interface
4. An example is the PmodCLP by Digilent (www.digilentinc.com) available from the IEEE student branch

Project requirements:

1. You must display the message "Hello World" on the LCD screen on the top line of the LCD display.
2. If a button is pressed, you must display a second message of your choosing on the top line of the LCD display.

Project Demonstration and Lab Report Submission

Your lab report should follow the lab Submission guidelines (see the course web page).

Grading

Simply completing the project assignment is only sufficient to get you 90% of a complete grade. In order to get 100%, you will need to complete an extension of your choosing. Some suggested extensions include: creating custom characters using the LCD screen, creating a choose-your-own adventure game with the buttons and the LCD screen, using the screen in "nibble mode", etc. A successful basic demo is worth 50% of your project grade, and the remaining 40% depends on the quality of your report.

Tips

Be sure to read the datasheet for the LCD controller. The boot-up process for the LCD controller is quite long and particular - you must meet these timing requirements. You must also meet the timing requirements of the E, R/W, RS signals in the "write cycle" for each and every write to the screen (even for config data). If you are not sure if you are meeting these timing requirements, use a scope to check your signals. Make sure that you are also meeting the voltage requirements for the LCD screen.

Questions

1. How fast can the microcontroller write characters to the LCD screen and still have the LCD screen function? What is the total KBps (kilo-bytes-per-second) of this max data transfer rate?
2. What is the max rate the ATmega328 can write out PortD in KBps? Assume that the ATmega has a 16 MHz system clock.