GPIO How To Guide

In many embedded controller applications, there is a need to interface with external devices, including simple LEDs and pushbuttons, LCD displays, motor controllers, and sensors.

To use a GPIO pin on the TM4C123GXL board, you should look at the documentation on the class web page. Pins PF0-4 (LEDs and pushbuttons), PA0-1 (UART0 to virtual COM port), and PC0-3 (JTAG) are connected to devices on the board. The schematics show the connections.

The ports are labeled A-F, with each port having up to 8 I/O pins. Most of the pins can be used easily, but there are some pins requiring special attention (see Table 10-5). In particular, you should not use the PC0-3 pins as those are used by the JTAG interface which is used to program and debug code on the target board.

Before using any pin on a port, the clock for a port must be gated on. This is done by setting the appropriate bit in SYSCTL_RCGCGPIO_R. The data sheet states that 3 clock cycles must occur before accessing any GPIOx_* registers for port x.

In class, we will use the advanced peripheral bus (APB). You should make sure the the appropriate bit for the port is cleared in SYSCTL_GPIOHBCTL_R (this is the power-on default setting).

After the clocks are enabled, you will need to configure the pin for the intended operation.

To make a pin a digital push-pull output, the appropriate bits in GPIOx_DIR_R and GPIOx_DEN_R should be set.

To make a pin a digital open drain output , the appropriate bits in GPIOx_DIR_R, GPIOx_DEN_R, and GPIOx_ODR_R should be set.

To make a pin a digital input, the appropriate bit in GPIOx_DIR_R should be cleared and the appropriate bit in GPIOx_DEN_R should be set. If a pull-up or pull-down is needed for the digital input, set the appropriate bit in GPIOx_PUR_R or GPIOx_PDR_R.

To make a pin an analog input, the appropriate bits in GPIOx_DIR_R and GPIOx_DEN_R should be cleared and the appropriate bits in GPIOx_AFSEL_R and GPIOx_AMSEL_R should be set.

For a digital output (push-pull or open drain) or a digital input, if you want a peripheral such as a UART, SSI, or PWM modules to control the pin, the appropriate bit in GPIOx_AFSEL_R should be set and the appropriate nibble in GPIOx_PCTL_R should be set to 1-15 (see table in 23.4 for the value to use).