# EE/CPE 3280 Assignment – Touch Control of Motors and Servos

## Overview

In this project, you will combine touch sensing with control of DC and Servo motors.

## Basic Operation

The motor control program will interface with an Adafruit Motor Shield to control the speed and direction of a DC motor and the position of a servo motor. A CapSense slider will control the speed of the motor, and the Pioneer Board button will control the direction.

## Specifications

1. LED Control – A CapSense slider will control the color of a two-color LED
   1. The programmer may choose any two colors from (Red, Green, Blue). Call these LEDA and LEDB.
   2. When the slider is touched at the bottom position, LEDA shall be completely lit, and LEDB off.
   3. When the slider is touched at the top position, LEDB shall be completely lit, and LEDA off.
   4. When the slider is touched between the top and bottom positions, LEDA shall be lit to a degree proportional to the distance from the top position, and LEDB shall be lit to a degree proportional to the distance from the bottom position.
2. Motor Directional Control – The pioneer button will control the direction of the motor.
   1. At startup, the DC motor shall spin clockwise.
   2. Each time the Pioneer Button is pressed, the DC motor shall change direction
3. Motor Speed Control – A CapSense slider will control the speed of the motor.
   1. The speed of the motor shall be proportional to the position at which the slider was last touched
   2. When the slider is touched at the bottom position, the motor shall be stopped
   3. When the slider is touched at the top position, the motor shall turn at its maximum speed
   4. When the slider is not touched, the motor shall continue turning at its current speed
4. Servo Control – A CapSense slider will control the angle of a servo motor
   1. The angle of the Servo shall be proportional to the position at which the slider was last touched
   2. When the slider is touched in the middle position, the servo shall be moved to the 0 degree position
   3. When the slider is touched at the bottom position, the servo shall be moved to the 90 degrees left position
   4. When the slider is touched at the top position, the servo shall be moved to the 90 degrees right position

## Implementation

1. Use the PSoC4 CapSense module with a 5-Position Linear Slider Widget
2. Use a single TCPWM in PWM mode to control the LEDs. Connect one to the Line signal and one to the Line\_N signal.
3. Use a TCPWM in PWM mode to control the speed of the motor.
4. Use an SPI (UDB based) module to talk to the motor controller to change the direction of the motor.
5. Use a TCPWM in PWM mode with a period of 20ms to control the servo motor
6. Use an edge-triggered interrupt to detect Pioneer button presses

### Important Tips

1. See the course slides on motors for instructions on how to interface with the motor control shield.
2. The TowerPro SG90 micro servos have a different input range than most servos. 0.5 ms is full left and 2.4 ms is full right.

## TO TURN IN Through Canvas

Turn in the following:

1. Submit a single MS-Word document containing the following through Canvas
   1. Top-level schematic (select all of your drawing, copy and paste it into the Word doc)
   2. main.c (Select all text with ctrl-a, copy and paste into the Word doc)
   3. Modified portions of all ISR .c files (usually just the “Includes” portion and the “Interrupt” portion). Make sure that you have a header at the top of each file that identifies its purpose.
   4. Copy in any other files that your created or modified
2. Demonstrate your program to the instructor during class time on the due date. (Online students may send a video demo to the instructor)
3. Return your motor shield, DC motor, Servo motor, propeller, and battery pack to the instructor.