

Authors:
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Date:
Project Name: Lab 4 revised Mar 20, 2020

Description

In this lab, you will work in a **team** of 2-4 people. Since this is the case, the code given to you is extremely minimal. You will work together to control a dc motor using the L293D amplifier supplied in every kit. Using the potentiometer, the speed of the motor will be controlled.

Instructions

First, you will need to be able to capture an analog voltage from a potentiometer that can swing from 5V to 0V.

The digital value captured from the potentiometer will control the duty cycle of the PWM signal that controls the speed of the motor. This PWM output will be connected to the L293D amplifier and this amplifier will connect to either side of the motor.

You will use one motor. The motor is controlled by a difference in voltage between its two terminals. Therefore, to get it to spin forward at full speed, it is only necessary to apply a 5V signal to one side of the motor and 0V to the other side. The change in voltage from the potentiometer will control the change in speed of the motor in a continuous manner until it reaches the maximum speed.

You should be able to turn the entire system on and off by pressing a debounced switch.

Extra Credit (10 points): Use two motors as originally planned for Lab4. This will require two PWM signals (one for each motor). When the potentiometer is at its lowest point (~ 0V), only one motor will be on at full power. When the potentiometer is at its highest point (~ 5V), the other motor will be on at full power and the other one will be off. When the potentiometer is in the middle (~ 2.5V), both motors will be on at full power. This behavior emulates that of wheels turning in a car with the potentiometer being the steering wheel and the motors being the wheels.

#Requirements

Overall

1. Code must be readable and well commented.
2. Every file must contain code related to a single device. For example, the ADC and PWM code must be separated. The main function is an exception.
3. There are no non-trivial SFR manipulations in the main function and are wrapped in functions that have meaningful names
5. A state machine is used to implement the bulk of the functionality of the program

ADC

1. A function exists to initialize the ADC
2. Uses the A0 pin as an input

PWM

1. Uses a PWM on timer 3.
2. Has a changeDutyCycle function.
3. Extra credit will use PWMS on timer 3 and timer 4.

Timer

1. Uses a timer (0 or 1) to debounce states.

Switch

1. Uses a switch to turn motor on and off.
2. The external interrupt must be of the type INTn (not PCINT) that is used for switch debouncing. The interrupt sense control should be configured for any logical change on INTn generates an interrupt request.

Demo of Lab4

1. You may do one of the following for demonstration of your results:
 - a. You will demonstrate your results to your TA using Zoom at the scheduled time (preferred approach).
 - b. Your group will make a video and submit it to D2L showing the functionality.