

Driving a Stepper Motor

This week, we discussed the permanent magnet stepper motor and how to drive it using full-step and half-step patterns. For this week's lab, you will drive a stepper motor with your Discovery board under control of software you will write.

This lab will count for 3.75% of your course mark. You may choose to work in pairs and submit a single report for both lab partners; marks will be the same for both partners. You will each be responsible for knowing the complete material in the lab. Working in pairs is not mandatory; you may choose to work individually.

As always, when building circuits and when working with active circuits, wear safety glasses.

Due: **Wednesday** 5 February 2020

Submit your code listing, schematic, and required scope screen shots to the eConestoga dropbox by 11:59 pm

Submit lab report to dropbox including:

- Your commented c source code and header files
- Schematic showing the connections from the Discovery board through the L293D H-bridge to the stepper motor (colour coding of leads) (neat hand sketch is OK)
- Labelled scope shots using the logic analyser and parallel bus decoder showing port bit patterns for the motor full-stepping and half-stepping in both directions. A typical scope shot is shown at the end of this document.

Demo when completed or during inter-class period during the week

The basic steps of the lab are:

1. Write and debug code to read the state of the joystick on the Discovery board
2. Write and debug code to write stepper patterns to the upper 4 bits of GPIO port E.
3. Determine that the code works by showing that the appropriate bit patterns are appearing on the port pins in the appropriate sequence using the logic analyser function of the oscilloscope
4. Add L293 & stepper motor connection as outlined in class. Power the L293 from a 5V bench supply. Set the current limit of the supply to 200 mA. Remember to connect the ground of the Discovery board to the ground of the breadboard carrying the L293.
5. Demonstrate that the system works by spinning the motor under software control in both directions by full and half stepping. The joystick press will determine the direction of rotation and the step type.

You will need to write the following:

- Functions to initialize the GPIO ports connected to the joystick and stepper motor appropriately
- A function to read the joystick and return its state. The function will always return even if no button is down. It will return one of 6 values indicating which button is pressed, or a special code you define indicating nothing is pressed. It must ***not*** busy-wait until a button is pressed.
- A function to take a single step with the stepper motor based on a single input parameter of step type that can take on the values -2, -1, 1, 2 to indicate full and half stepping in either the clockwise or counter-clockwise direction. Note that this function will need a static variable to keep track of the current index into the step pattern table.
- A main() to call functions to initialize the ports and then loop forever doing the following:
 - Check for a joystick button by calling the joystick function
 - If anything pressed
 - Take the appropriate step by calling the step function
 - Delay in a delay loop

To receive maximum credit, use good coding style, appropriately separate your code into modules, and comment as outlined for previous labs.

