LAB 3
Stepper Motor Controller

NAME: POSSIBLE POINTS: 10

COURSE DATE & TIME:

OBJECTIVE:

- To interface and drive a Stepper Motor
- To program the 8051 to use the I/O Port to send out properly timed and pulsed logic signals. These signals will energize the coils inside the stepper motor in the correct order to drive the motor forward and backwards a precise number of degrees.

OPERATION:

Two Pushbutton (switches) will be added on the breadboard and interfaced to the 8051 on Port 0. When the "Left" Pushbutton is pressed the Stepper Motor will turn 45 degrees Counter-Clockwise, when the "Right" Pushbutton is pressed, the Stepper Motor will turn 90 degrees Clockwise. If no button is pressed, the Stepper Motor will stay at it's current position. The program will loop this indefinitely. The movement will be strictly timed such that the 45 degree movement will take 2 seconds and the 90 degree movement will take 4 seconds. Timing has to be handled by one of the 8051 timers.

Hint: You will have to calculate how many steps it will take to move from 0 to 45 degrees, including the gear reduction, then divide 2 seconds by the number of steps to determine the delay time you must wait in between each full-step.

ELECTRICAL CONSIDERATIONS:

You will be energizing 4 coils in the stepper motor, each controlled by one pin. A pin of any MCU including the 8051 is incapable of supplying the necessary current to energize these coils. In order to solve this problem you will have to figure out how to drive the much larger current of the coil in the stepper with the smaller current from the MCU port pin. In the embedded system kit there is a ULN2003 Darlington Pair Transistor Array. **This Integrated circuit must be removed from the small development board it is on and wired on your breadboard.** Unlike the LED you **cannot** sink the current through the LED therefore one of the previous mentioned solutions **must** be utilized. The textbook has suggestions as well, look at the motor control chapter.

LAB WRITE-UP AND DELIVERABLES:

The lab write-up will include this page as the cover sheet with any questions answered and the source code. Also a schematic of your specific implementation will be included. You must draw your schematic using proper Schematic Capture software like CircuitMaker. Also include a picture of your demo

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DEMO AND GRADING:

When your project is ready, you will demonstrate the functionality to the instructor and hand in the write-up. Your demo will be graded on its ability to move to the desired 180 degree position and back to 0. Since the program will continuously loop driving between 0 and 180 degrees, we can see any error or loss of steps add up to an overall position error.

QUESTIONS:

How much current can your driver sink?

What is the resistance of each individual coil being driven?

How much current will your driver have to sink when the coil is being energized?

How many degrees will the motor (before the gear reduction) move with each step, assume we are driving in full-step mode?

How many degrees will the motor shaft (after the gear reduction) move with each step, assume we are driving in full-step mode?

How many steps are required to move 45 degrees?

How many steps are required to move 90 degrees?

How long of a delay is needed between steps?

What value should I load in the Timer register to create this delay?