LAB REPORT

ENGINEERING LABORATORY

ENGR 1204, FALL 2022

Laboratory Exercise #8

Laboratory Name: Arduino PWM

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WENTWORTH
Institute of Technology

Objective: Arduino software program is used to control the direction and speed of a Sumobot's wheels as it is connected to a PC.
Procedure & Results: The code used to run the Sumobot had to first be set up in the Arduino Software program:

After code is written, the sumobot is setup. First, the Arduino Uno board is connected to a PC. Then, set output pins as 9 and 10. A $P_{integer}$ value is inputted to set up a duty cycle. Once pins and duty cycle have been established, a square sin wave is checked to come out of pin 9. BNC Cable is then connected from oscilloscope to Arduino. Arduino code begins after connection from oscilloscope to Arduino. Bench Power Supply is set to 5 V and this powers on the sumobot. Once set-up of code and sumobot is complete, various $P_{integer}$ values were plugged in so that the wheels of the sumobot both rotate in the same direction and at the same speed:

	Left Motor and Wheel		**Right Motor and Wheel**	
Motor Behavior	**Duty Cycle (%)**	**$P_{(integer)}$ (integer, range 1-1024)**	**Duty Cycle (%)**	**$P_{(integer)}$ (integer, range 1-1024)**
Forward Fastest	6.5%	67	8.5%	87
Forward Slow	7.4%	76	7.6%	78
Stopped	7.5%	77	7.5%	77
Reverse Slow	7.6%	78	7.4%	76
Reverse Fastest	8.5%	87	6.5%	67

1) Fill out the following table (fill out the left motor only) and show all the equations/calculations:

Motor and Wheel	
Duty Cycle (%)	**$P_{(integer)}$ (integer, range 1-1024)**
6.5%	67
7%	72
7.4%	76
7.5%	77
7.6%	78
8%	82
8.5%	87

6.5/100 = 0.065 * 1024 = 66.56 ~ 67

7/100 = 0.07 * 1024 = 71.68 ~ 72

7.4/100 = 0.074 * 1024 = 75.776 ~ 76

7.5/100 = 0.075 * 1024 = 76.8 ~ 77

7.6/100 = 0.076 * 1024 = 77.824 ~ 78

8/100 = 0.08 * 1024 = 81.92 ~ 82

8.5/100 = 0.085 * 1024 = 87.04 ~ 87

2) Figure out how to set PWM Period T to 20 mS. Determine and write what integer value in microseconds should be used to do this (show math calculation).
T = 20 ms = 20,000 µs (show work for conversion).

20 ms -> 20 * 10^3 = 20,000 us

PWM Period was 20 milliseconds and was converted into integer value as 20,000 microseconds. $_{integer}$ values within 6.5% to 8.5% duty cycle were calculated for Sumobot's servomotor. We realized that for the wheel to turn in the same direction at the same speed, the $P_{integer}$ values of the left motor must be inverse to the right motor.

Summary: Arduino code was able to successfully run on the Sumobot and turn the wheels on the left and right servomotor when $P_{integer}$ values were inputted. This lab also showed that because the left and right servomotors were on opposite of the Sumobot, their $P_{integer}$ values had to be inverse from one another. That means that the left servomotor's fast clockwise rotation is the right servomotor's fast counterclockwise rotation. And that is true for all rotation direction and speed of the servomotors.