**2-4 Milestone One: Pulse Width Modulation Lab**

Chris Bridges

Southern New Hampshire University

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Professor Bryant Moscon

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**Lab Questions**

1. At what frequency can you see the LED start to blink?

import RPi.GPIO as GPIO

import time

GPIO.setwarnings(False)

GPIO.setmode(GPIO.BCM)

GPIO.setup(18, GPIO.OUT)

frequency = [60, 50, 40, 30, 20, 15, 10, 5, 2, 1]

for freq in frequency:

print(f"Testing frequency: {freq} Hz")

pwm = GPIO.PWM(18, freq)

pwm.start(50)

time.sleep(5)

pwm.stop()

time.sleep(1)

GPIO.cleanup()

I created this to determine at what frequency the LED started to blink. I noticed the LED starting to blink around 15hz all the way to 1hz. Using this program with a list was much easier than modifying the code in Jupyter Notebooks, saving, and running the Milestone 1 program with one change at a time.

2. At what duty cycle is the intensity of the LED perceptibly diminished from the initial 50% duty cycle?

I added print statements and slowed the interval to .5 seconds for this question. Around 40% duty cycle, the LED bulb became much dimmer. When the duty cycle reached 30% the intensity reduced even further.

3. When changing the duty cycle of the PWM, the loop used an increment of 5 every tenth of a second. Was this perceptibly smooth? If not, what could you change to improve the visual response? Why?

The fade was somewhat smooth, but the differences in duty cycle were more noticeable at lower levels. Reducing the increments to a smaller number, like 1 or 2, would make the transition smoother. Changing the interval to a smaller number could also make the transition smoother.

4. What function sets the PWM frequency for a GPIO line?

The line of code “pwm18 = GPIO.PWM(18,60)” sets the GPIO output number 18 to 60hz.

5. What function sets the duty cycle for a GPIO line?

The line of code “pwm18.ChangeDutyCycle(dutyCycle)” sets the duty cycle percentage during the loop, while the line “pwm18.start(0)” initializes the duty cycle at 0%.