Boston University
Electrical & Computer Engineering
EC463 Senior Design Project

First Prototype Testing Report

Integrated Laser and Electronic Model for Photoacoustic Neural Stimulation

By Team 19
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Equipment and Setup:
The equipment we used and the setup for the lab prototype is consistent with how it was described in the test plan. During the prototype test, the equipment that team used was mainly just used the code on Arduino IDE, the Arduino, the oscillator scope, timer, and other miscellaneous items like gator clips and wires. The setup is relatively straight forward. The team first connects the computer to the Arduino that's running the software to generate certain pulses using codes from the IDE. Then, we connect the pins appropriately using alligator clips and jumper wires to the oscillator scope to see proper results. Generally, the computer uploads changeable code to the Arduino, then the Arduino generates some waves to display on the oscillator scope. As for the pins, the first jumper wire is connected to one of the PWM pins on the UNO pin 9, and the other is connected to the ground pin. The other end of the jumper wires are then clipped to the alligator clips, with red corresponding to the PWM output and black corresponding to the ground pin. From there, the BNC connector is attached to the oscilloscope and a quick preliminary test is run to auto-scale to the current scale used for the frequency. The voltage will remain in a constant range of 0 to 5 volts and so the vertical axis of the oscilloscope should not need to be adjusted after the first adjustment. The actual testing is just changing the frequency, duty cycle, and time it. Overall, it went pretty much as expected from the test plan.

Discuss Detailed Measurements taken:
The major measurements taken were just some time in the unit of seconds. The initialization phase was setting frequency to 1kHz, duty cycle 50%, and one number sequence. The recorded data was with frequency of 10Hz, 30% duty cycle, and sequence of {200, 100, 50, 150, 100}. The time recorded for this was on for 20 seconds, off for 10 seconds, on for 5 seconds, off for 15 seconds, and on for 10 seconds, which is what we expected. Another recorded testing was with frequency of 1.7kHz with sequence {15000, 8500, 10000}. The recorded time in unit seconds were 8.8, 5, and 5.9. These are the major recorded measurements for the key testings. However, other varied variable parameters were also shown to demonstrate for testing, specifically, frequency, duty cycle, and sequence.

Conclusion:
Based on the testing and the discussions with the proctors (Professor and GTA), the test was successful because the output displayed is pretty much what's expected. The arduino is able to output a voltage that is matched with PWM signal with the initialized duty cycle and frequency. The timing for on and off is corrected based on the sequence as shown in the previous section. The time that the output displayed PWM matches the time it takes the output cycle through the number of pulses specified. This again is demonstrated from the recorded data. One major change to our current project is to find a more accurate and precise way of timing the sequences. The way the timing works in the prototype testing is just set a timer and approximate the time which introduces a certain degree of errors. However, a new implementation to time this more

precisely is to use a Pico. The team will introduce some algorithms to time the sequence's on and off time with great precision. Overall, the testing is a success and we'll be able to check if there's any other issues like delays and so on.