Boston University
Electrical & Computer Engineering
EC463 Senior Design Project

First Prototype Testing Plan

Integrated Laser and Electronic Model for Photoacoustic Neural Stimulation

By Team 19
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Required Materials:

Hardware:

- Arduino Uno
- Arduino Uno usb connector.
- Oscilloscope
- BNC to alligator clips wire
- M/M Jumper wires
    - For output and other arduino pins
- Computer device for hook up

Software:

- Arduino code
    - Using arduino IDE
    - Timer1 library extension
    - Output square waves given certain frequencies and duty cycle
- Objective
    - If index is even there will be pulse, otherwise break

Set Up:

The set up is relatively simple and mainly deals with connecting the computer running the software to the arduino UNO, as well as connecting the pin and ground of the UNO to the alligator clips which will connect to the oscilloscope for interfacing and visualization of the waveform. The computer connects to the UNO and the ports are correctly connected so the code may output. The code will be altered during the test to use different values for various functions of the system, so it is necessary to have multiple uploads and keep the computer plugged into the arduino. The first M/M jumper wire is connected to one of the PWM pins on the UNO, in our case this pin has been specified to be pin 9, and the other is connected to either of the ground pins. The exposed portion 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.

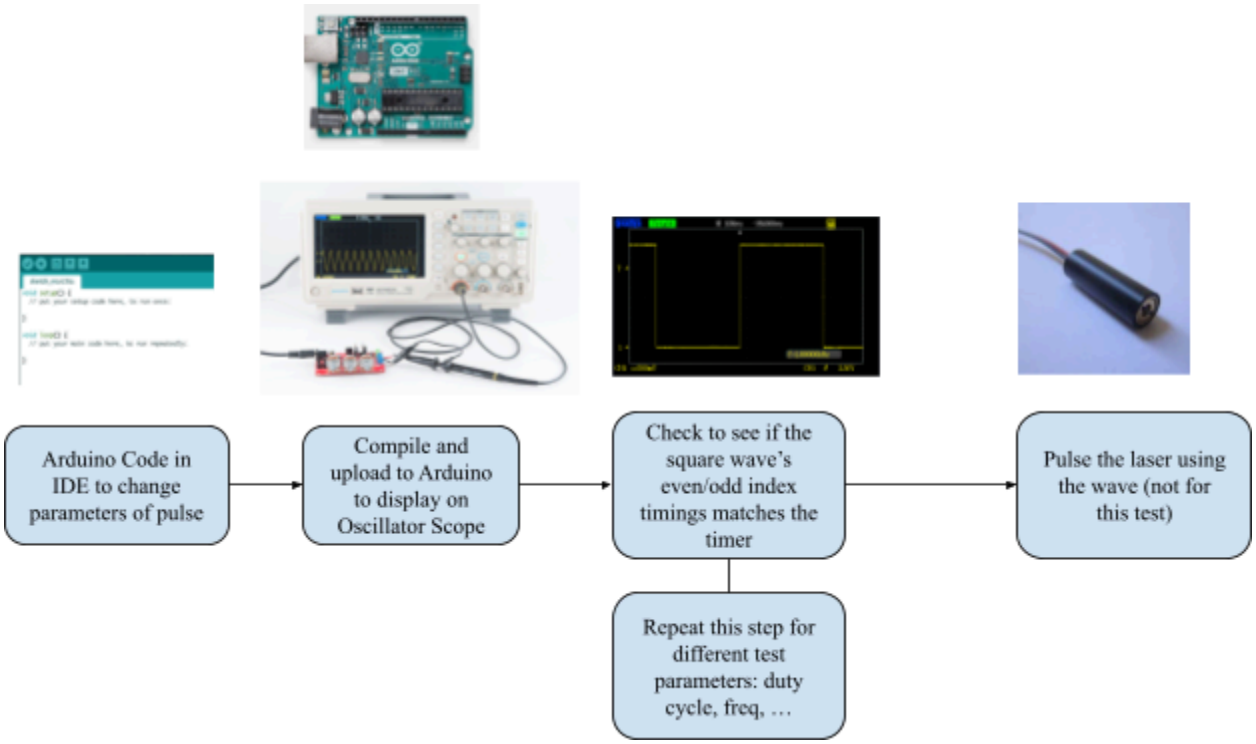
Pre-testing Setup Procedure:

Hardware/Oscillatorscope side:

1. Connects Arduino to a PC
2. Hooks Arduino to the oscillator scope through M/M jumper and alligator clip
3. Set up a timer for tracking
4. Scale the oscilloscope as see fit
5. Change setup if needed for different parameters (frequencies, PWM, duty cycle)

Arduino side:

1. Ensure that the Arduino pins are setted up correctly
2. Run the prototype code to ensure everything runs as expected
3. Compile and upload the code into Arduino board to begin the test
4. Change code if needed to demonstrate certain behaviors



Testing Procedure:

1. Set the frequency to 1kHz, the duty cycle to 50% as an initial test, and the sequence to one number measuring anything above 30k to allow for significant time running, and observe the output to be identical to the above parameters
2. Change this variable frequency to 0.5kHz, 100Hz, and 10Hz, while also altering the duty cycle to 75%, 25%, and 30% and ensure the output matches the specified parameters
3. Alter the sequence while still at 10Hz and a 30% duty cycle to be {200,100,50,150,100}, and set a timer while running this code to ensure the sequence follows being on for 20 seconds, off for 10, on for 5, off for 15, and again on for 10. This is to ensure that the timer works as expected.
4. Change the frequency to 1.7kHz and adjust the sequence to be {15000,8500,10000}. Once again time this and ensure the length of time for the outputs is again matching the values of approximately 8.8, 5 And 5.9 seconds. This will allow for easy insurance that the microsecond delay in the code is functional along with the millisecond one.

Measurable Criteria:

The criteria for successful running and output is as follows:

I. The Arduino is able to successfully output a voltage that matches a PWM signal with duty cycle and frequency matching to what they were initially set at the start of each test
II. There is a clear time for which the output of the arduino turns off and on again assuming the sequence variable has more than 2 values in it
III. The time for which the output displays PWM is equal to the time it would take for the output to cycle through the number of pulses specified in sequence. This should also be true for the time in which the output is in the off state and no voltage is being output.
IV. The voltage output is 0 at the end of the sequence to insure no interference with other machinery when being used in actual trials.

Source Plan:

Object	Category	Yes/No
Teensy 4.1	Recyclable	Y
Jumper Wires	Recyclable	Y
Clamp	Recyclable	N
Computer Interface	Recyclable	Y
Result:		85%

Hardware Pinout:

P3 Pin #	Usage/Description
GND	GND connection
9	Output Signal