Final project idea(s):

A wearable device that beeps and vibrates to keep its user focused. It will sound when the user uses his/her computer.

I plan on executing this through one of two ways:

1. Using a tilt sensor to detect when a computer screen is flipped on
    - Drawbacks:
        - I know how to use tilt sensors, but the calibration may be tricky. I tried making one during lab 7 (see https://jenny-15.github.io/PHYS-S-12-Assignments/2019/07/18/Session07.html for more information), and it was very inconsistent.
        - I used a small container, water, and capacitance. The capacitance was difficult to work with because it was disturbed very easily whenever the sensor shifted or its wires moved.
        - Maybe if I used an actual tilt switch like this one: https://www.adafruit.com/product/173 it would be more reliable
        - I would have to make a whole other circuit on the computer, making it bulky
    - Benefits:
        - If I used a tilt switch it would probably be pretty reliable
2. Creating a program that will run when once a computer is turned on, outputting to the Arduino to turn on the buzzer+motor.
    - Drawbacks:
        - I do not have much experience with code, so writing the program to achieve this would be a lot more difficult
            - I do not know how to create a program that runs automatically whenever my computer turns on that outputs to an Arduino
                - https://www.howtogeek.com/228467/how-to-make-a-program-run-at-startup-on-any-computer/
        - This may be too difficult for me
    - Benefits:
        - I would not need to physically attach anything onto my computer
        - This would be more reliable than the tilt sensor
        - It would be able to detect when the computer is actually on instead of simply detecting the physical movement of a close laptop to an open one

Design:

My design will be fairly similar to what I did for my prototype. I will have a wristband with a circuit concentrated in one area, sort of like a watch.

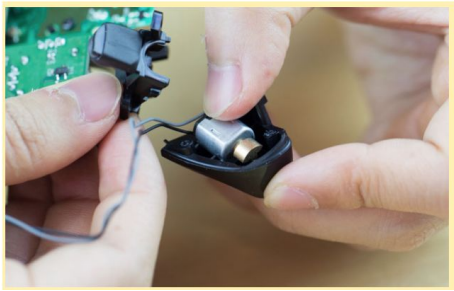
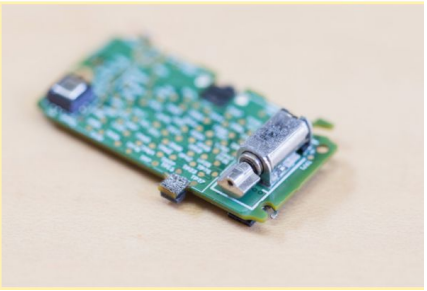
Materials:

Buzzer-

- A Piezo buzzer
- They are a little bulky

Vibration motor-

- I will use a ERM vibration motor
    - Pros
        - They are more powerful than coin vibration motors
    - Cons
        - They are bulkier and less compact than coin vibration motors
        - I will have to make a container to hold it because it does not stick in place
            - I also have to bolt it down somehow
        - There is a free-spinning mass that must have room to rotate within the container
        - I will mount the motor either through housing (left) or securing directly (right)

Lights-

- I may potentially add LED strips like these: https://learn.adafruit.com/adafruit-neopixel-uberguide/the-magic-of-neopixels
- These will turn on with the vibration motor and buzzer to further incentivize users to close their computer

- They may be an unnecessary addition since I already have a buzzer and vibrator
- I would have to modify the design of my wristband and it may also become bulkier
    - I would have to find a suitable material
    - I am unsure how I would incorporate it into the wristband
    - It would be hard to connect it to the Arduino through the wristband
- The lights would either circle around the enclosure or run down the wristband, but this would probably not work very well logistically since I am not directly connecting the wristband and enclosure.

Circuit-

- It would be ideal if I could create a soldered protoboard
- This will be challenging since I do not know how to make one

Enclosure-

- I need to make an enclosure for the circuit that depends on if I make a protoboard or PCB
- It needs to accommodate the bulkiness of the buzzer and vibrator
    - The vibrator also needs to be ERM vibrator has to be secure
- Potential materials (for 3D printing)
    - Should be rigid
    - POLYAMIDE (PA)
        - PROS • Toughest plastic material • Bends without snapping • Relatively inexpensive • High chemical resistance • Food compatible (check with supplier if it's colored Nylon!) • High softening temperature
        - CONS • Nylon filaments are prone to absorb humidity fast and need to be properly stored
    - ACRYLONITRILE BUTADIENE STYRENE (ABS)
        - PROS • Stronger than PLA • Long lifespan • Inexpensive • Wide variety • LEGO® uses this plastic so it must be good CONS • Warping can be an issue • Not biodegradable • It can shrink significantly when it cools down • Unpleasant and toxic fumes when printing
    - Regula Polyactide (PLA)
- I would like to make the enclosure in the shape of a hexagon if it not overly bulky

Wristband-

- The material for the wristband depends on the circuit that I make (PCB or soldered protoboard), if I decide to add LED strips, and how I make the enclosure.
- Instead of mounting the circuit enclosure I as did in the prototype, I think I will probably attach it somehow
    - The band would probably be hooked onto the enclosure
        - This would conserve space and make everything less bulky

            - It would create a better shape overall because the wristband is curved when wearing it, so the enclosure would have to adhere to that rounded surface if it was mounted on, which would be tricky
                - I would not have to compromise the flexibility of the wristband or the hard structure of the enclosure
- I want the wristband to have one of 2 properties:
    - Stretchiness:
        - It has to be able to hold on its own when not stretched but still have the room to expand
        - I would like 3D print something like this for the wristband: http://www.hk3dprint.com.hk/en/gallery/Fashion-Accessory/Nylo-Flexible-Stretch
            - It is able to stretch upon expansion
            - This make be difficult to attach to the enclosure because will probably add a rectangular hook to the enclosure
            - I am not sure how strong this would be because the enclosure would have a weight that needs to be accounted for
            - Or I could make something with a simpler pattern like a zigzag but it would probably be even weaker than the other design (http://www.hk3dprint.com.hk/en/gallery/Fashion-Accessory/Nylo-Flexible-Stretch)
    - Adjustability:
        - This would be much simpler than a stretchy design and more secure
        - The design would be like a standard watch strap
- Potential materials:
    - The materials for this wristband need to be flexible so that the design can expand or at least bend to adhere to the wrist
    - PLA- polyactide (preferably the flexible kind)
        - PROS • Odorless • Not petroleum-based • Biodegradable • Inexpensive • Wide variety
        - CONS • Low temperature resistance • Low strenth • Brittle
    - THERMOPLASTIC POLYURETHANE (TPU)
        - PROS • Flexible • Abrasion resistant
        - CONS • Not the best for tiny details
    - GLYCOL MODIFIED PETG
        - inexpensive, naturally transparent, flexible and durable material that has found its way to FDM 3D printers aiming to match the strength of ABS plastic with the ease of use of PLA plastic.