Aspiration Assisted Motor-Driven Biopsy Needle

Report: 10-17-2024

1. **Work Planned to be Completed:**

For this week I plan to reorganize, standardize, and simplify all the current code for the biopsy needle operation such that future modifications and additions can be easily made. This will ensure that there will be at least a framework for someone else to continue any future work with this project after I have completed my capstone. I also need to complete my component document that keeps track of operating voltages, currents, etc. Additionally, I need to move my documentation and other files onto Teams and look into setting up a GitHub repository.

Housekeeping wise: I need to finish reading Yibo’s and Dane’s papers as well as organize a table of due dates for the Design Course and have that sent to Dr. Greenslet. I also need to look at the quadrature encoder documentation to better understand how it works.

After this is looking into implementing an adjustable speed control. Currently, my plans are to implement this using some potentiometer device so that users can input their desired settings. The speed control values are digitally held in 8-bit formats allowing for 0-255 range of different values. Users should be able to twist knobs or push sliders to adjust these values. In order to accomplish this, there will need to be some screen to indicate what the specific values are for testing purposes. I plan to do this with an OLED/LCD device that will display: 1) real time current output and 2) Motor speeds. This might demand a new state diagram to accommodate for setting the speeds. The required libraries seem to be already present in the TEAMS files: #include <Adafruit\_GFX.h>, #include <Adafruit\_SSD1306.h>

Another task planned for this week or the near future is completion of a KiCAD library for used electronic components in the needle design. This means collection or creation of symbols and footprints. Additionally, I would like to get the schematic wired at least up to the point of the current circuit design. This means I will need to look at the previous design student’s work.

1. **Work Completed:**

The first order of business for this week was getting the code into a clean and stable state so that future additions could be easily done. This involved reorganizing the general structure, deleting legacy or obsolete test code, adding comments for obscure lines, and giving proper identifiers. The previous state of the code was difficult to work with as functions had no descriptions or representative names. Additionally, after investigation, some functions did not even do what they were contextually supposed to do such as a velocity calculator without any time-dependent quantities. I have renamed most functions and added all the information necessary to make additions and changes. This will also make it much easier for another programmer to continue any work without being bottlenecked by having to laboriously discover what it actually does. More importantly, this gives me a better understanding of what the code does and gives me the necessary perspective to add features such as the LCD and adjustable motor speed.

***Before:***

**A screenshot of a computer program

Description automatically generatedA screen shot of a computer program

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***Figure 1:*** *See how the function revo is for the most part a mystery here as are the c=a and c=b statements in CountA(). Additionally, there are just many things that don’t follow normal convention for programmers like lacking prototypes, indents, and a general messy layout which makes it difficult to follow and find necessary information.*

***After:***

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**A screenshot of a computer program

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***Figure 2:*** *Most of the code is now organized into sections with descriptors for usage and other considerations. Additionally, functions now have appropriate names and have the proper information regarding what they actually do.*

I was also able to begin work on developing the circuit schematic for the biopsy needle. I’ve made my own symbols for the current sensor and decoder and those are currently contained in a custom library. After I finalize all the components, I will add these to the teams or some repository with instructions for KiCAD. Additionally, I have recovered some the 3D model for the decoder and the footprint for the sensor which will free up time that would have been spent making them from scratch.

A diagram of a circuit

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***Figure 3:*** *KiCad schematic for the needle biopsy. Most of the important pins and signals have already been assigned. Aside from finishing this up, the next important things to do is ensure that there are footprints for each component to be used for the PCB. All of this will eventually end up consolidated in a custom library.*

A computer screen shot of a computer

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***Figure 4:*** *An example of some of the models and footprints I’ve already collected. Having these will make quicken the eventual PCB design process.*

1. **Future Work:**

This week I did not get to complete as much work as I would have liked to. My immediate focus is getting the LCD operating and displaying inputs for the speed. Getting the current readings on the device should not be difficult. As for obtaining inputs, and displaying them, this will likely require more important changes (state changes). Additionally, I would like to complete making the footprints for the leftover components. I will have to check with Carsten to also ask about some alternatives for supplying the circuit without a 12V battery so that it can be more mobile. Future investigations will involve how, aside from displaying it, we can get current data from the circuit in an organized format as Arduino does not natively support file saving and alternatives may come with their own challenges.

**Current CEN3907C Due Dates**

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| --- | --- |
| *Assignment* | *Due Date* |
| Pre-Alpha Build | 10/25 |
| Driver Lab | 10/31 |
| Elected Lab | 11/1 |
| Design Plan Revision | 11/1 |
| Prototype Presentation | 11/19 |
| Design Prototype | 11/22 |
| Presentation Reviews | 12/3 |