EE/CprE/SE 491 WEEKLY REPORT 7
10/25/2024 – 10/31/2024

number: ***sdmay25-17***

Project title: ***Microbial Pill Sensor***

Client &/Advisor: ***Dr. Meng Lu***

Team Members/Role:
Roles still subject to change as we transition from research to design phase.

- ***Wes Ryley:*** Data Transmission Design Lead
- ***Rakesh Penmetsa:*** Bacteria Housing Design Lead
- ***Alex Upah:*** Biosensor Design Lead
- ***Cade Kuennen:*** PCB Design Lead

Weekly Summary

This week, we had a team member become ill which limited the amount we were able to accomplish this week. We also presented our lightning talk in front of the class this week, down a person, which limited our time spent on the actual design of our microbial pill sensor. In our weekly meeting with Dr. Lu, we discussed future tasks of the further simplification of the components used for our macro-scale prototype we have developed throughout this semester. We have identified the components of our current XIAO ESP32 Dev Kit which will not be necessary for inclusion in our final design, allowing us to miniaturize our MCU component. Further work needs to be done to miniaturize our photodetection component. At this point in the project, we have identified future breakout roles as we work on the miniaturization of our current prototype.

Past week accomplishments

Team:

- The team was not able to accomplish as much this week due to the illness and lightning talk presentation previously discussed in weekly summary. We were able to find the necessary documentation on the current components used within our current prototype that will allow us to break these components down into miniaturized versions. We have started further identification of components and breakdown of current components necessary for project miniaturization.

Cade Kuennen:

- Started looking into component decomposition of the XIOA ESP32-C3 dev kit

    - Was not able to make it very far in this endeavor, but I have identified what components we are 100% going to need for our simplified design.
- Started searching for a schematic of the photodetector used in our breadboard prototype to do part decomposition for that portion of the project as well.
    - Was able to find a schematic, but it doesn't have too much information on it. Will continue to search for a better annotated schematic

Alex Upah:

- Reviewed COMSOL physics software as a modeling tool for our final biosensor design.
    - Has capability to enter a variety of physics as well as temperature, optical and electric circuit physics
    - Modeling physics of bio fluorescent response will be challenging, but found a potential work around via a COMSOL help page thread that is worth exploring.
- Reviewed optical components for the uniform dispersion of light
- Reviewed commercially available options for Photodetectors on pcb board along with necessary filtering.

Wes Ryley:

- Researched into the creation of a front-end GUI for displaying data and controls.
    - This GUI would be hosted on an app and would run a Python script in order to accurately display concentrations.
- Researched into the creation of a back-end processing system.
    - This code, also in Python, would take transferred data and process it to accurately convert the voltage given from the PD circuit into a concentration.
    - This conversion would then be displayed on the GUI.

Rakesh Varma:

- Worked on creating housing and how to convert the kicad file to the Fusion 360 and creating cell housing around it

Pending issues

Alex Upah:

- Finalize components for uniform dispersion of light in chamber
- Finalize lensing and filtering components for optical electronics in design.

Wes Ryley:

- What app or hosting site should run the GUI and processing system.

Individual contributions

NAME	Individual Contributions *(Quick list of contributions. This should be short.)*	Hours this week	HOURS cumulative
Cade Kuennen	Searched for a schematic of the TSL2591 for part decomposition, started component decomposition of	6	43

	XIAO ESP32-C3 dev kit, worked on in class assignment, lightning talk and presentation, and design document		
Alex Upah	Reviewed COMSOL physics modeling software. Reviewed optical components. Produced presented lightning talk, design document, and other assignments for class.	6	39.5
Wes Ryley	Dedicated time to researching GUI creation with Python. Dedicated time to researching back-end processing and coordinating with GUI.	6	42
Rakesh Varma	Started working on the Cell housing of the pill	5	36

Plans for the upcoming week

Team:

- Continue to work on component identification and decomposition.

Cade Kuennen:

- Continue working on part decomposition for the ESP32-C3
- Look for a better annotated schematic of the TSL2591 for part decomposition

Alex Upah:

- Continue to review COMSOL Multiphysics potential application to design product
- Working on selection of optical components.

Wes Ryley:

- Select an app or hosting site that will host our GUI and processing.
- Start the creation of the GUI and allocate memory to data processing.
    - No data processing can be created until substantial data has been collected.

Rakesh Varma:

- Continue to work on cell housing and make a layout for the pill

Summary of weekly advisor meeting

Discussed with Dr. Lu about the next steps for the project.

- Create a front-end GUI on a hosting software or site that can interact with a connected BLE device.
- Potentially purchase a XIAO ESP32-C3 Devkit to conduct testing on the power usage, BLE transmissions to GUI, and start recording data to continue progress on other aspects of the project.
- Begin creation of the housing unit design and conduct trial tests with 3D printing to ensure the prototype module meets all needed requirements.
    - During this process, document errors and changes in design to ensure progression.
- Develop a PCB design that incorporates the simplified XIAO board and the TSL2591 Photodetector circuit.

Discussed with Dr. Lu about the current market of CPUs.

- Learned about different structure types like RISC and CISC and how different sides of the industry operate off of these specific structures.

- Learned about the operations that INTEL does where they design the CISC architecture, manufacture, and incorporate the CPUs into their own processors. This is very different from the RISC side of the industry where AISL and other corporations dedicate specific portions of the production timeline to enhance efficiency and often times beat INTEL to new creations.