

EE/CprE/SE 491 WEEKLY REPORT 3
9/27/2024 – 10/3/2024

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

The main objectives for this week were to simplify and revise our high-level system design, produce a 3D flow down of our high-level system design and decide on components we will be using for our design.

During the week, Cade produced a 3D design for our microbial pill sensor and revised our system sketch using the team design produced last week. We presented this 3D design to our faculty advisor Dr. Lu and discussed the design and potential modifications. We decided the current high-level design was good, but we must introduce a lensing mechanism to focus our fluorescence onto our photodetector. We also discussed simplifying our future PCB design to a single board with multiple layers, rather than two separate boards, but we do have concerns whether this will be feasible or not.

With Dr. Lu, we also decided on using the ESP32-C3 for the MCU in our design. We also decided on the components we will be using for our simple breadboard testing in the upcoming weeks, in which we will be using the ESP32 T Display and TSL2591 Lux sensor. These components will allow us to replicate the functionality of our smaller PCB design for prototype testing on breadboards. For future actionable items, we decided that our next steps will be to get the MCU to turn on our LED and read data from the photodetector. Our stretch goal for next week is to then transmit the data from the MCU to a pc.

Following a discussion with Dr. Lu, we have postponed any discussion regarding housing, lensing, or temperature sensing until basic breadboard functionality is achieved. These were listed as goals for the week but will be postponed until we have a working prototype on the breadboard.

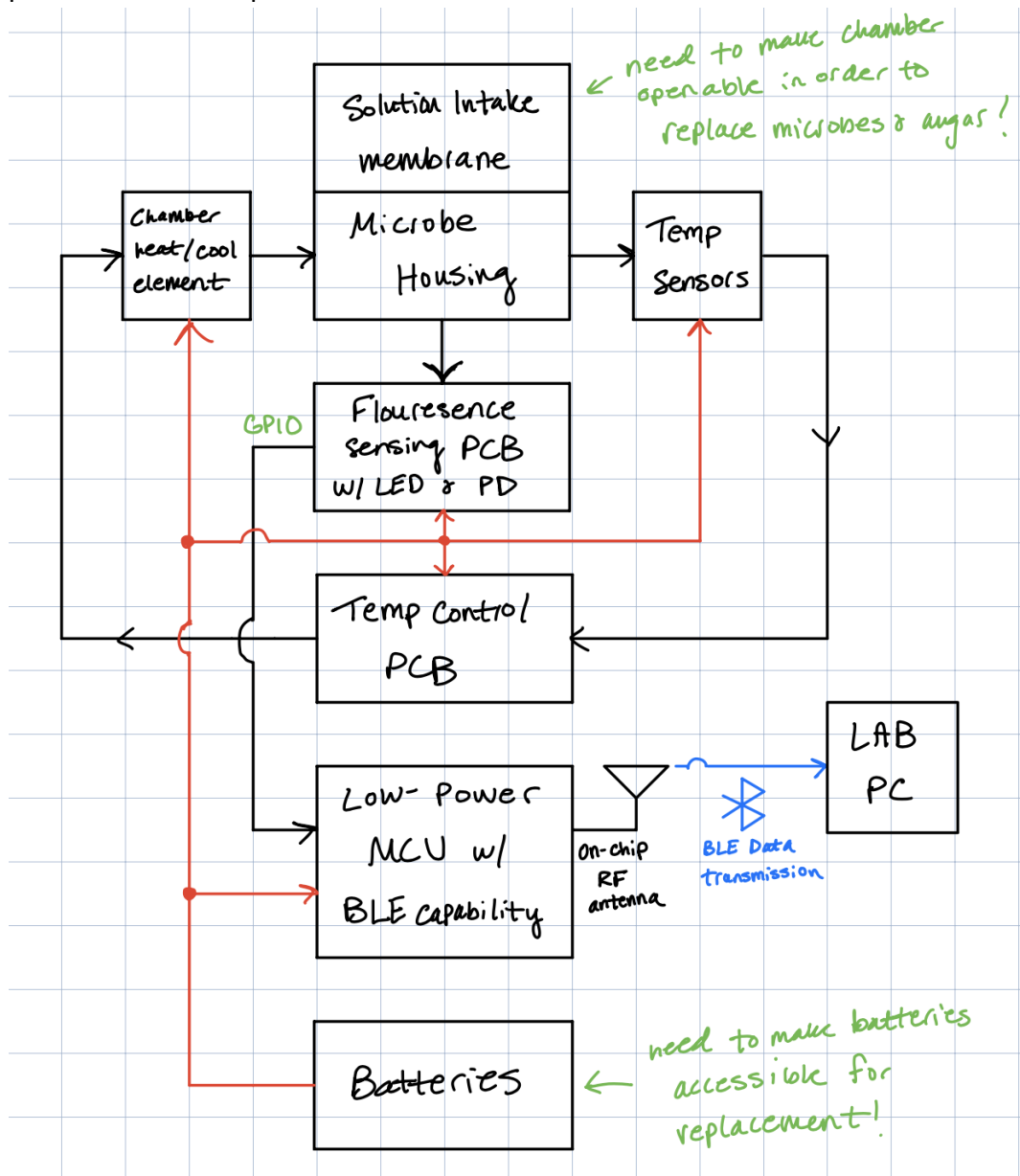
Past week accomplishments

Team:

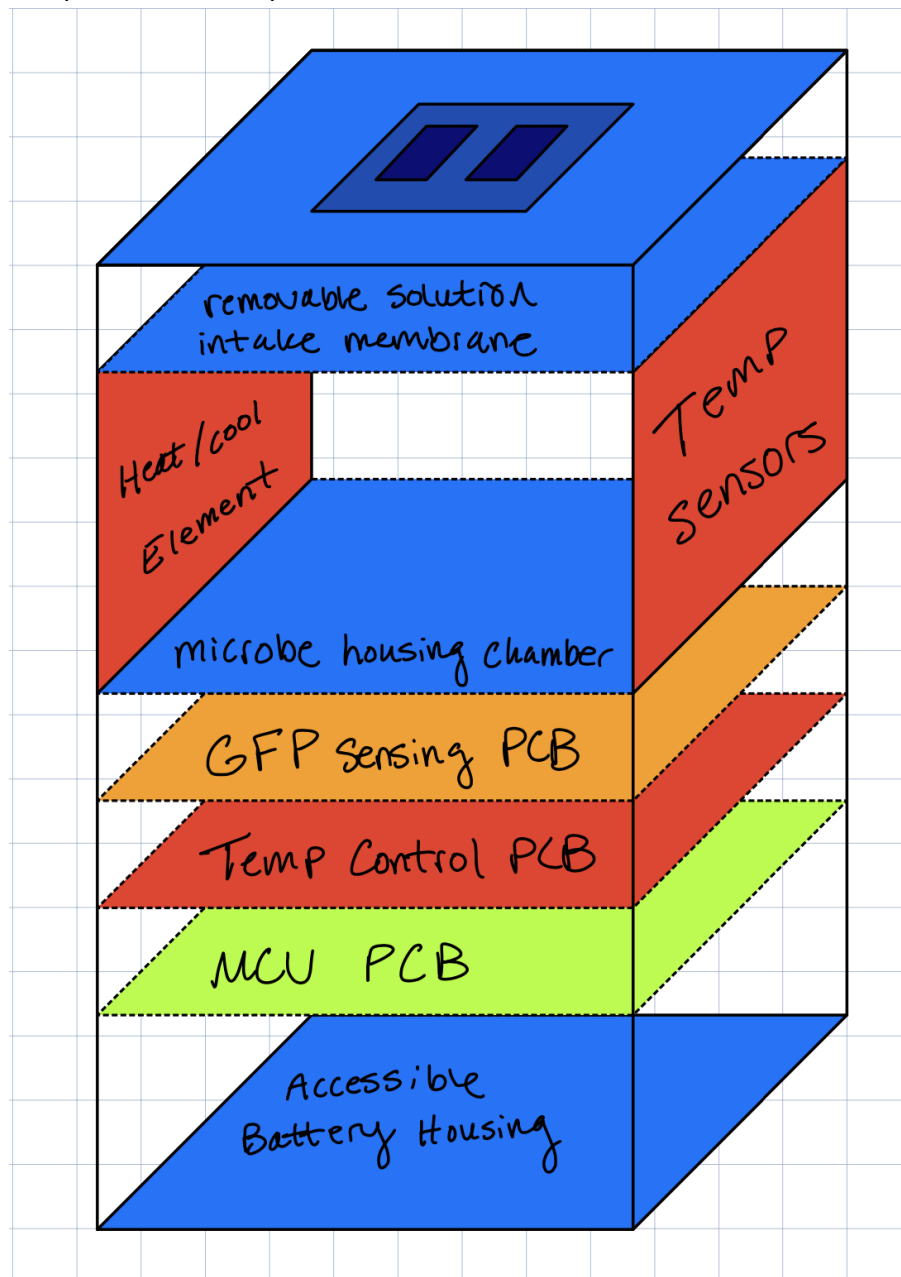
- Decided on the ESP32-C3 as MCU to be used in future PCB design as it meets our size, power and transmission capability requirements.
- Obtained breadboard prototyping components: ESP32 T-Display with 1.14 inch LCD and TSL2591 Lux Sensor, standard LED and infrared filter / lensing device.

Cade Kuennen:

- Revised the High-level sketch to have more of a flow-down feel to it and more accurately represent where components will be located in relation to each other:



- Created a 3D view of the system sketch to get a better understanding of where in the housing components will be placed:



- Soldered the breadboard legs onto the MCU we will be using for breadboard prototyping
- Alex Upah:
- Reviewed basic principles of lensing.
 - We will need to calculate the focal point of our lens to align with the distance of the lens from the photodetector. This will be dependent on the sizing of our lens and PCB design.

Wes Ryley:

- I downloaded and reviewed how the Arduino software works.
 - In charge of developing the code for the MCU chip to function. This involves both the circuitry that runs both the LED and the PD.
 - In charge of developing the code for the MCU to transmit data via Bluetooth.
- Looked into how transferable the code is depending on which MCU is being used. Currently, the testing MCU is different than our prototype MCU which may cause complications when transferring between them during the later stages after testing.
- After meeting with Dr. Lu, we settled on the ESP32-C3 instead of the ESP32-C2 for the prototype we are developing.

Rakesh Penmetsa:

- Product research and worked on Fusion 360 for gaining hands on experience.

Individual contributions

<u>NAME</u>	<u>Individual Contributions</u>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Cade Kuennen	Created a revised version of the high level system sketch created for our design. Created a 3D view of the system sketch. Worked on lightning talk presentation and weekly report. Soldered breadboard legs onto our MCU dev kit. Conducted product research to decide on prototyping components.	6	16.5
Alex Upah	Contributing to design discussions, and revisions. Coursework completion outside of class time. Review of lensing principles. Contributed to team action of obtaining prototype components.	4	13.5
Wes Ryley	Download and review the Arduino software. Look into how to create code for our specific application. Component research to decide which MCU and PD would work best for our prototype.	4.5	13.5
Rakesh Penmetsa		3.5	14

Plans for the upcoming week

Team:

- At this point in the project, we do not have assigned duties for individual team members. As a team, we collectively plan to accomplish the actionable item of getting MCU to turn on LED and read output of photodetector. As a stretched goal for the next two weeks, we hope to successfully transmit data from photodetector to the lab pc via Bluetooth connection.

Wes Ryley:

- I plan to work on creating a skeleton code in Arduino to control the ESP32 that we have. Once the ESP32 is soldered, we can run tests to verify the code works and our MCU has

solid connections. If possible, attempt to create a skeleton code for data transmission via onboard Bluetooth.

Cade Kuennen:

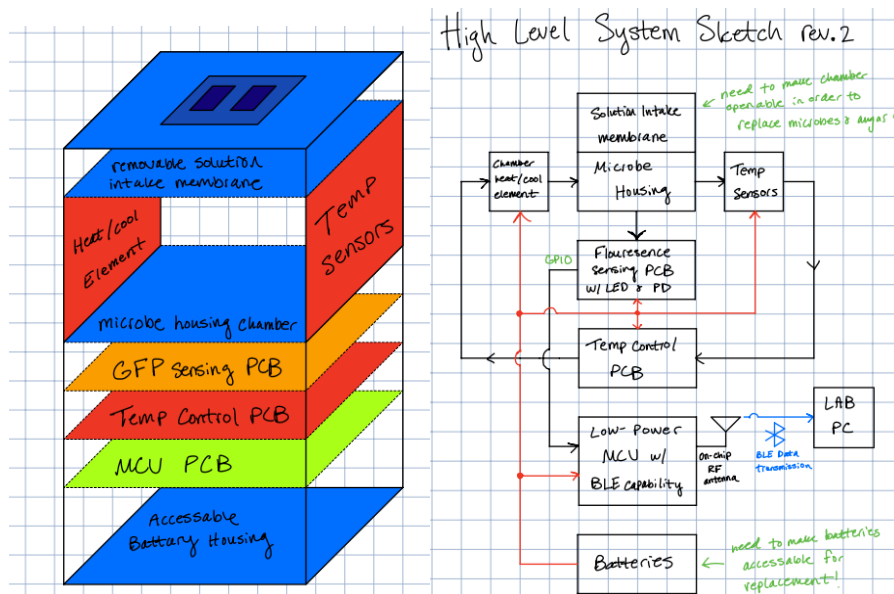
- Plan on learning more about the Arduino IDE and read into the TSL2591 Lux sensor and ESP32-C3 data sheets along with other team activities specified above

Rakesh Penmetsa:

- Try to learn how to add libraries to fusion 360.

Summary of weekly advisor meeting

During our weekly meeting with Dr. Lu, we presented our revised high level system sketch and 3D high-level design. Following our presentation, we discussed potential additions to the design, which are namely the addition of a lens and filter for the photodetector as well as a lens to make field produced by LED uniform in chamber. We also discussed revisions to PCB, moving from two separate boards for the various components to integrating the components into two separate layers on a single PCB board. This would allow us to save both space and money in our design.



We also settled on a MCU for the design, which will be the ESP32-C3, which fits both our sizing and data transmission requirements. Dr. Lu was then able to provide us with similar components that would allow us to build a simple prototype of our design. We established that our goal for next week is to be able to turn the LED on via the MCU and read the data from the photodetector into the MCU.

We also discussed some of the future complexities of the design, including the membrane and housing design, incorporating temperature sensing and some sort of pumping mechanism to remove incoming solution. We also discussed timing related to turning on the LED. All of these were decided to be secondary concerns as of now, where our initial focus is to produce a breadboard prototype before transitioning to the PCB design and worrying about these additional complexities.