EE/CprE/SE 492 STATUS REPORT 03
2/13/25 – 2/27/25

number: ***sdmay25-17***

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

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

Team Members/Role:

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

Weekly Summary

During this work duration, the team discovered a lot more issues that need to be addressed before operation can begin. During the development of the GUI program through google Colab, Wes discovered the issue of exporting and importing data to and from excel could be a cause of concern. A perfect program operation would allow for the MCU device to store data into a cloud google sheets without the need for an interconnecting device, however this seems unlikely as without a stable BLE or Wi-Fi connection data transfer would be difficult.

Past week accomplishments

Cade Kuennen:

- Waited for first round components and PCBs to arrive:
  - Components arrived 2/19/25.
  - PCBs arrived 2/26/25.
- Ordered larger 30mm diameter version of MCU utilizing ESP32-C3-WROOM-02U instead of my decomposition of it for testing BLE transmission 2/20/25.
- Helped Rakesh brainstorm housing ideas for PCB housing chambers.
- Started organizing components, material, and equipment for PCB building:
  - Obtained solder and flux from ETG.
  - Got information on where microscopes are located.
  - Talked to ETG about potential use of heat gun / hot plate and solder paste for soldering.

Alex Upah:

- Made testing document highlighting
- Contributed to decision to develop pcb containing full ESP32-C3 mcu for testing purposes of transmission.
- Helping Wes with transmission architecture.

Wes Ryley:

- Brainstormed list of additional GUI and processing functionality:

    - User settings
        - Duration of data collection
        - Interval between collecting data
        - USB or BLE connection
        - Possible controls of LED if needed
    - Collect data in Excel Sheet
        - Steps to data collection:
            1. Collect data via connection in program
            2. Convert raw data to processed information
            3. Push data to Excel page to keep and create graphs
        - This data would include:
            - Output Voltages
            - Time of recording
            - Device # or name
    - Give user option to select range of time to graph data, then graph in GUI
    - Attempt to implement GPS tracking through google maps.
    - Disconnect from device option
- Continued development of the GUI program and the Sheets connection.

Rakesh Penmetsa:

- Designed the cell housing based on the previous feedback on the positioning of the PCB and when going through the approach for connecting the USB connection, does the USB need to be waterproof since it is for lab-controlled testing? This creates issues with attaching and ensuring reliable connections. And finally decided to invert the and make the modifications

<u>Pending issues</u>

Team:

- Need to finalize housing design and fabricate prototypes using CNC machine
- Need to solder components on pcbs that have arrived, but we do not have stencils, which will make soldering incredibly difficult.
- Working on figuring out transmission of data from MCU directly to google sheets using google colabs.

Alex Upah:

- Travel for multiple graduate school visits reduced the amount of time I was able to contribute to the project over the last two weeks.

Wes Ryley:

- Looking into MQTT protocol to serve as median between MCU and google sheets with BLE connection.

Rakesh Penmetsa:

- When going through the approach, positioning the blue light filter lens and sensor lens. Because the space between the sensor lens and the sensor is 3mm and by placing blue light filter will affect the focal point of the lens because of refraction. By placing the blue light filter lens on the top of the sensor lens could cause the blue light to travel from the side and gets passed can causes trouble and even need to consider the factor of refraction and how it affects the path of light.
- Could not finish the housing design and submit the design to make the C.N.C. model because there were a few modifications that were bought the notice after the group meeting and advisor meetings. So, starting to redesign the cell housing.

Individual contributions

NAME	**Individual Contributions** *(Quick list of contributions. This should be short.)*	**Hours this week**	**HOURS cumulative**
Cade Kuennen	Assisted Rakesh in brainstorming housing solutions, put together components list for larger 30mm diameter PCB design and sent them off, talked to ETG about soldering logistics for small sized PCB components.	8	26
Alex Upah	Developed testing document detailing initial testing procedures for each component. Contributed to discussions regarding housing redesign, generating backup larger MCU pcb, and transmission of MCU data.	6	18
Wes Ryley	Brainstormed ideas of what to include in the GUI for the MCU operation and data processing. Continued to try to overcome the issue of storing/collecting data through google sheets without the need for active connection with device. MQTT broker connection.	10	22
Rakesh Penmetsa	Redesigned the cell housing and made the design modification based on the new requirements that to make sure that it is waterproof.	9	22

Plans for the upcoming week

Cade Kuennen:

- Soldering components onto 20mm diameter MCU and Optics PCBs.
- Test soldering with continuity tests and power tests:
    - Ensure continuity only in expected places.
    - Ensure regulators are operating as expected.
- Work with Alex to commence other forms of testing.

Alex Upah:

- Test optical pcb to ensure functionality.
- Gather figures of merit for optical sensing component.
- Work with Cade on MCU pcb testing post soldering
- Continue to help with transmission and data storage.

Wes Ryley:

- Continue to develop the GUI programming until the MCU PCB has been assembled.

Rakesh Penmetsa:

- To update the housing design and submit the design to make C.N.C. model
- And Test the cell housing

Summary of weekly advisor meeting

Meeting Notes 2/19/25:

- Rakesh finished the updated 3D design to hold the updated PCB
    - Use the CNC machine to create outer case, may need to use aluminum for finished casing.
- Have acquired membrane filter in the lab which requires a pump to flow solution through the membrane and into the system.
    - Need to find a way to implement this into the housing container, whether it is placed inside or if it is resting in a fixed position on top.
- Still searching for an optical filter to use for blocking out the blue LED light. Similar functionality to UV filters used in yellow light lab rooms.
- Redesigned PCB board to include the ESP-C3 WROOM in case of failure with the current MCU PCB.
- Program needs to have a setting for user to decide whether they will use a USB connection for data transfer or establish a BLE connection. Implement into beginning GUI.
    - Give the user the ability to specialize controls, length of test or time interval between data collection. May need to program MCU with different variable inputs to function based on GUI inputs.

Meeting Notes 2/26:

- Received optical filter
    - Ensure that the filter does not interfere with lensing
    - Model a small housing container to hold both lens and filter above/near the PD

Research

https://mqtt.org/