User Needs and Requirements

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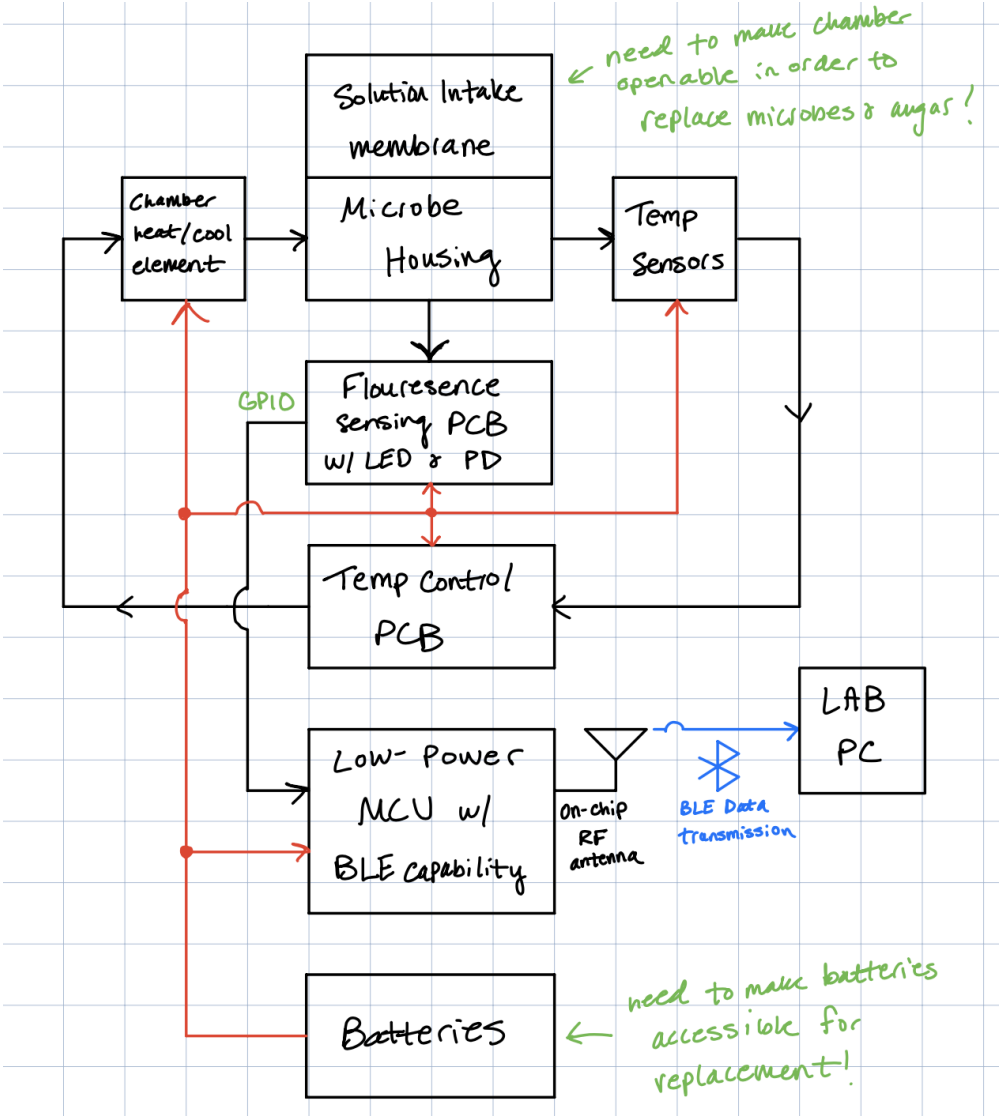
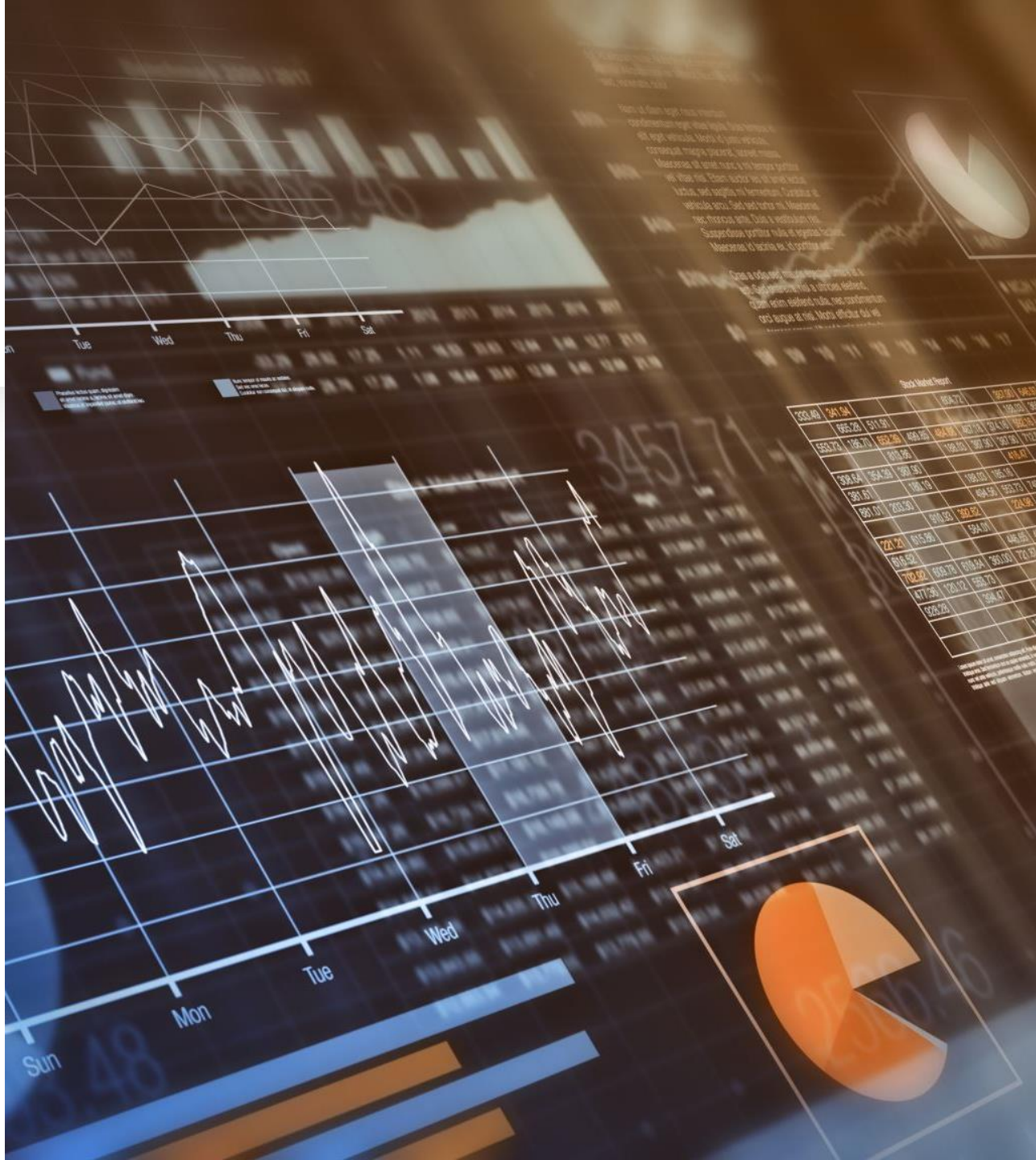
Project Overview

- Develop an Electrical system that will house, monitor, and transmit data that is collected from a bio-engineered biosensor.
- Monitor and control the temperature of the housing unit to maintain cell growth.
- Create a circuit that will excite the biosensor with an LED, as well as a circuit to collect the emitted response.
- Transmit the collected data through a Low-Energy Bluetooth connection.



User Needs

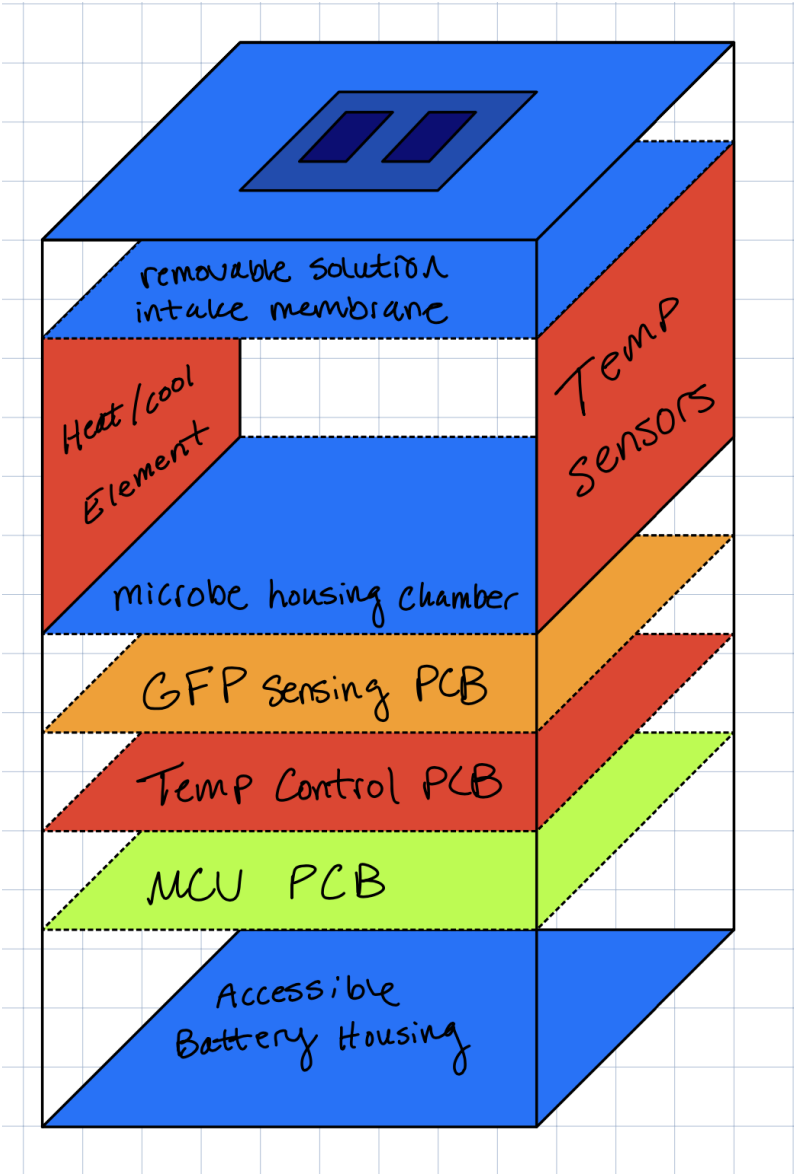
- Real-time Monitoring
- Portability
- Wireless Data Transmission
- Accurate Sensor Readings
- Cell Growth Maintenance
- Modular Sensors
- Durability and Reliability
- Low Power Consumption



Requirements

Functional:

- House-specified detection organism upon the necessary amount of agar gel
- Turn on LED component at the specified interval to disperse light uniformly in microbe housing chamber
- LED wavelength produces fluorescent emission from Green Fluorescent Protein expressed by bioengineered detection organism upon introduction of analyte
- Photodetector produces photocurrent proportional to the concentration of analyte due to fluorescent emission from bioengineered detection organism
- Filter membrane allows solution to flow into housing chamber containing the desired analyte
- Wirelessly transmits recorded voltage measurements to an external PC via Bluetooth



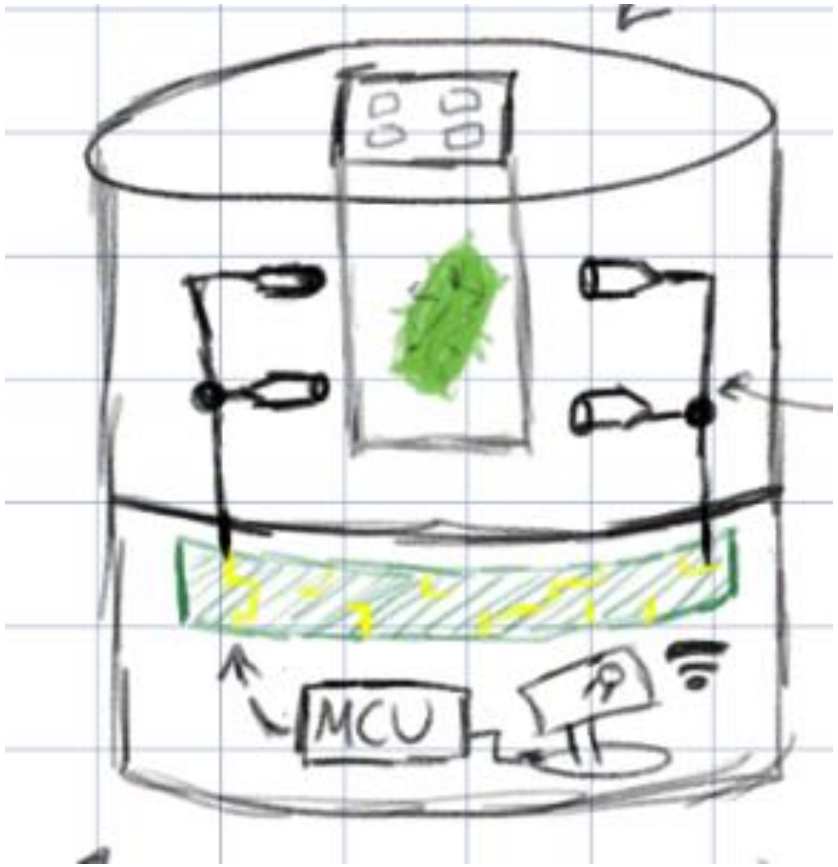
Requirements

Physical:

- No larger than 10x10x5mm
- Properly sealed housing compartment contains bioengineered detection organism
- Properly sealed housing compartment for batteries that allows for ease of replacement of batteries

User Experience:

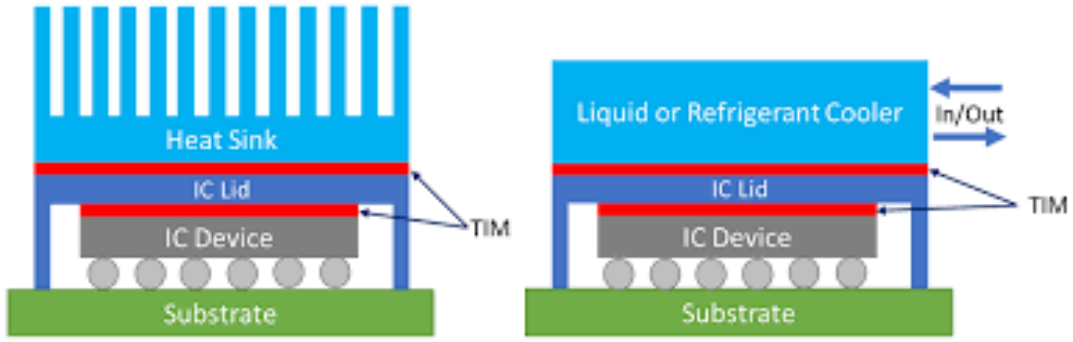
- Bluetooth Data transmission to any Bluetooth enabled device.
- Processing the transmitted data on the user end.



Requirements

Environmental:

- Temperature control for maintaining bacteria growth.
- Custom PCBs cannot overheat or interfere with the accuracy of the monitor.
- Use of lenses and filters to control the excitation of bacteria as well as the emissions



Engineering standards

- IEEE Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments: IEEE 1621-2004
  - Yes, this standard is important as our project is supposed to be used in a wide range of applications for bioengineers to choose from. Having the user interface be interactive and complete is important.
  - The standard mentions the power demands that devices require, and we will follow these standards to ensure we are providing a usable and great product.

Engineering standards

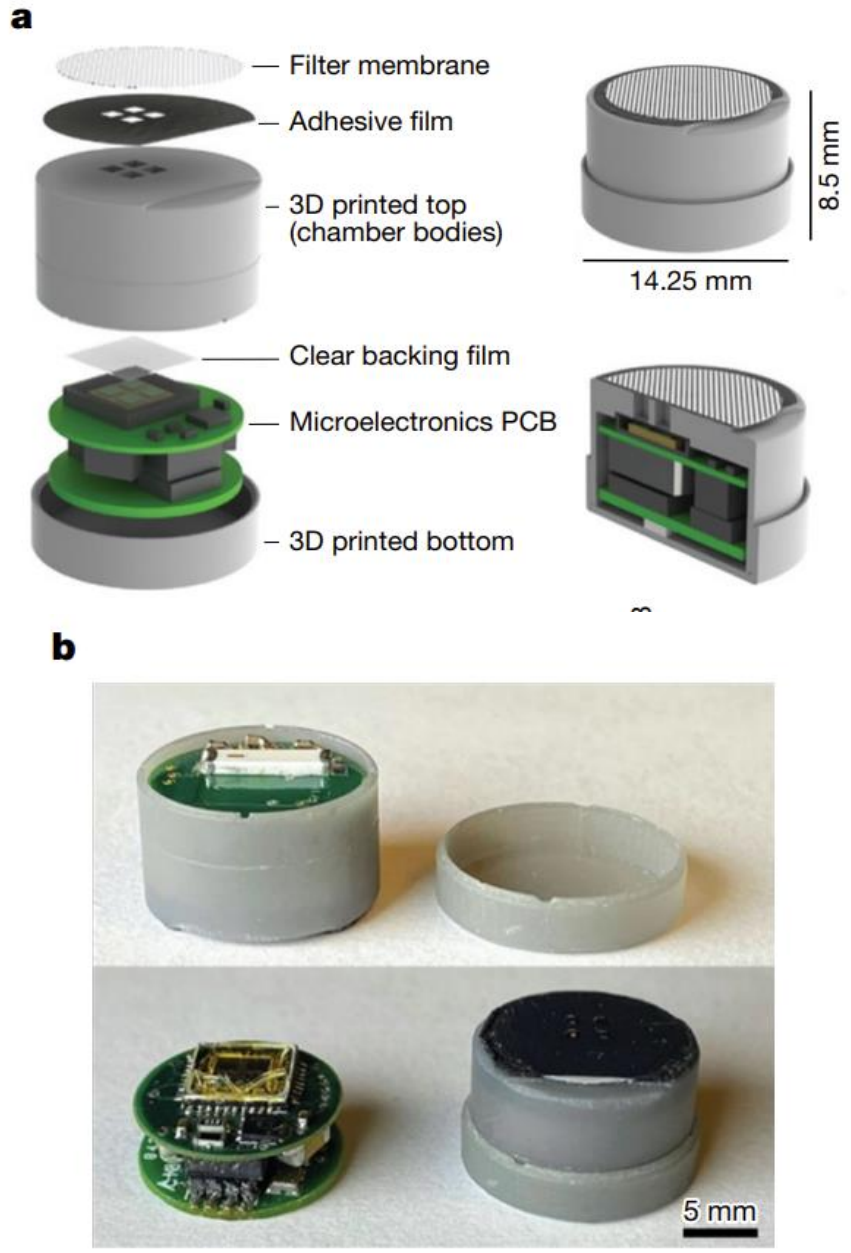
- IEEE/IEC International Standard Determining the peal spatial-average specific absorption rate (SAR) in the human body from wireless communications devices, 30 MHz to 6GHz: IEEE/IEC 62704-2-2017
  - This document isn't directly associated with our project but does give us good safety concerns to think about for possible later variations.
  - Possibly try to find a similar standard that is about Bluetooth connections and possible concerns with that.

Engineering standards

- IEEE Standard for Information technology--Telecommunications and information exchange between systems-Local and metropolitan area networks—Specific requirements
  - The IEEE 802.15.1 standard for Bluetooth Low Energy (BLE) directly supports the project's need for a low-power system to transmit data, addressing the limitation of Wi-Fi's higher energy demands inside the body.
  - The standard's focus on wireless communication protocols ensures reliable, efficient transmission of recorded voltage measurements from the sensor pill to an external device, aligning with the project's functional requirement for Bluetooth-based data transfer.

Conclusions

- Our project will incorporate the users' needs into the requirements to make a functional Bio-Sensor:
  - We are creating a low energy circuit that will control the excitation LED and emission sensing system.
  - We are implementing a Bluetooth Low Energy transmitter into our design to preserve energy.
  - We are utilizing a PID system to control the temperature of our housing to maintain bacteria growth.
  - We will implement filters and lenses to accommodate the specific user's needs.



Thank You and Any Questions