Team 37:AI-based Predictive Model for Long Term Viability Assessment of Mini-Organs in Culture

Taiming Chen, Steven Giang, Haoran Meng

Dr.Reem Khojah (Project Mentor)

Summary/Background

Team 37's project aims to design and construct advanced orbital shakers with an integrated camera tracking system. This system is designed for continuous imaging, tracking, and analysis of organoids over extended periods. The project incorporates a Raspberry Pi and Arduino for control and data processing, with a camera system enhanced through acrylic laser cutting and 3D printing for precise structural design. COMSOL software is employed for detailed analysis, while a cloud-based Raspberry Pi Zero setup is utilized for live imaging data storage. The growth of organoids is carefully monitored, and MATLAB software is used for sophisticated organoid tracking and analysis. This combination of technologies ensures a comprehensive approach to study organoids, enhancing research capabilities in the cell culture field.

Problem Definition

Organoid study is gaining attention as it offers a more accurate and ethical approach to modeling human diseases and testing treatments, effectively filling the gap left by traditional cell cultures and animal models. Additionally, organoid culture can enable doctors/researchers to develop precise, personalized treatments. However, there's a lack of affordable devices for continuous organoid monitoring combined with orbital shaking in the market. Our project addresses this by designing a cost-effective system for long-term organoid analysis, aiming to provide a durable and economically feasible solution compared to the overpriced options currently available.

Goals

Main Goal

- Monitor, image, and analyze organoids using a shaker device that can be built with less funds so that more facilities can observe and research organoid activities.

Other Goals

- Creating a consistent model for fluid mechanics analysis for organoids in six well plate through COMSOL.
- Build a camera system that requires less funds and is able to closely monitor organoid culture.
- Build an orbital shaker that can consistently shake for months in an incubator.

Progress

1 Shaker: Currently Purchased, plan to build one using CAD, arduino, and 3D printing.

2 Camera Tracking System: Currently have xyz camera system that can switch lenses maximum to 100x to mimic microscopic function

3 COMSOL Software showing advance and accurate fluid analysis in 6 well plate

4 Successfully grown brain organoids and performed media change following instructions and protocols

5 Already built the live data storage website to monitoring the organoids with the camera system in the incubator.
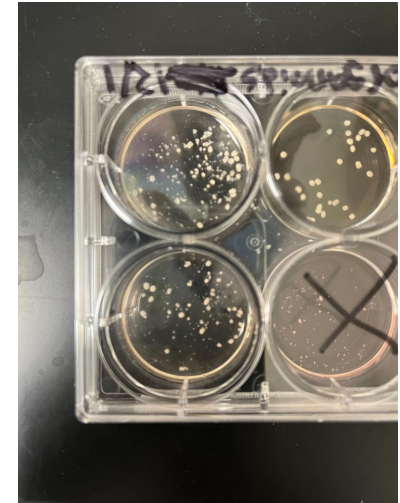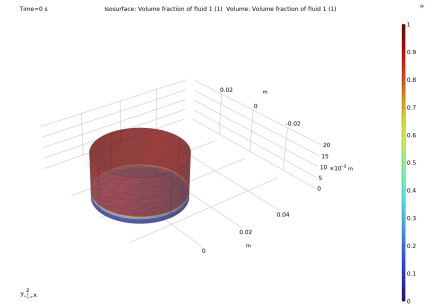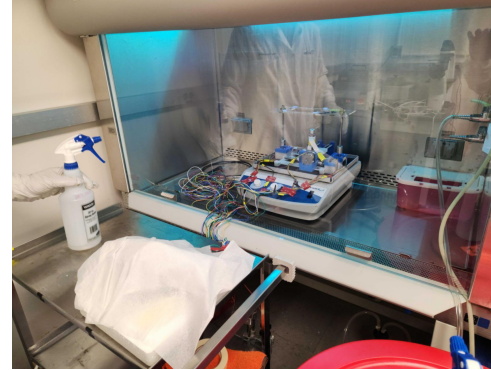
Timeline and Future work

Current checkpoint achievements

- literature review - finished during beginning of fall 2023 ✅
- xyz camera system - finished during early December of fall 2023 ✅
- COMSOL fluid mechanics analysis - finished during December of fall 2023 ✅
- Successfully growth organoids and doing media changes - finished during December of fall 2023 ✅
- Build a live monitoring cloud website for organoids -finished during October of fall 2023 ✅
- Have a functional orbital shaker that is able to fit in incubator -finished during October of fall 2023 ✅
- Designed a tracking software during orbital shaking -finished during November of fall 2023 ✅

Timeline and Future work

Future achievements need to be accomplished

- Advance xyz camera system with better wire management to prevent contamination - plan to finished during January of Winter 2024
- Practicing possible AI assisting with our devices - plan to finished during Feb of Winter 2024
- Accomplish the cycle of organoid monitoring experiment - plan to finished during December of Fall 2023
- Build a functional orbital shaker that able to fit in incubator -plan to finished during early February of Winter 2024
- Finished the first draft of the paper submission and reviewed by Dr.Khojah -plan to finished during early January of Winter 2024

Timeline and Future work

Possible side achievements need to be accomplished

- A six well camera system specially designed for 6 well plate with equal amount of camera system - possible achieve during the February in Winter 2024 ❓
- A new shaker that is able to orbital shaking with less funds - possible achieve during February in Winter 2024 ❓
- Better Cloud access for more quality and higher fps - possible achieve by end of March in Winter 2024 ❓

https://organoid2.sdsc.edu/
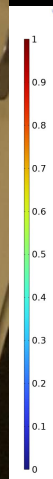
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Questions?

Thank You!

Taiming Chen, Steven Giang, Haoran Meng

UC San Diego