Agitation and Temperature Control of Sample Wells in Bio-Layer Interferometry

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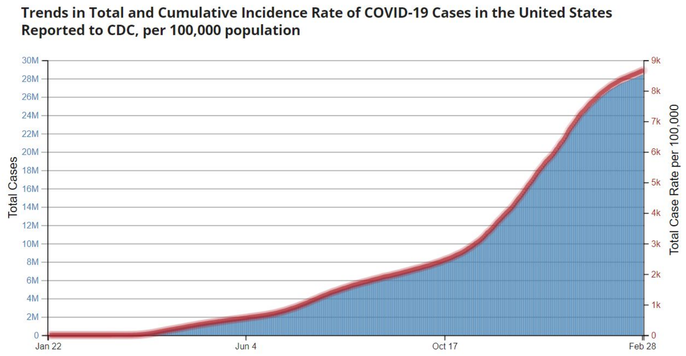
Project Goal and Background

- Over 28M COVID-19 cases and 511K deaths in U.S. [1]

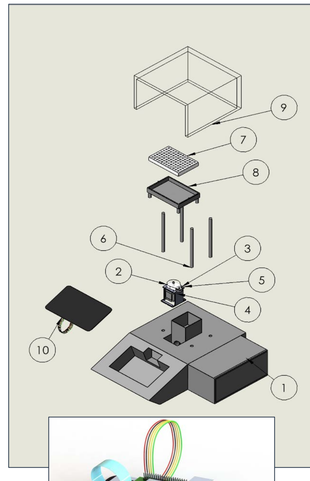


- Polymerase Chain Reaction (PCR) Test: sensitive and accurate, but has a result turnaround time as long as a few days [2]
- Antigen Test: inexpensive, rapid turnaround time (15 - 60 min), but less sensitive and accurate [2]

Goal: Develop agitation and temperature control system to cool samples for use in bio-layer interferometry based testing system.

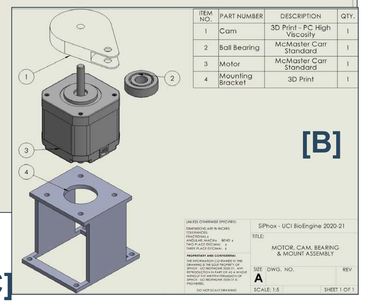
Project Design

[A]



ITEM NO.	PART NUMBER	DESCRIPTION	Material	QTY.
1	Housing Base	Weld		1
2	Cam (2)	3D Print		1
3	Ball Bearing	McMaster Carr		1
4	Motor	McMaster Carr		1
5	Mounting Bracket	3D Print		1
6	Rubber Rods	McMaster Carr	Polyurethane	4
7	Temporary 96 Well Plate	Amazon		1
8	96 Well Plate Holder	Weld		1
9	Cover	Assemble	Plexiglass	1
10	Screen and Pi	Assemble		1

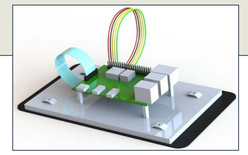
[B]



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Cam	3D Print - PC High Viscosity	1
2	Ball Bearing	McMaster Carr Standard	1
3	Motor	McMaster Carr Standard	1
4	Mounting Bracket	3D Print	1

SiPhox - UCI BioEngine 2020-21
TITLE: MOTOR, CAM, BEARING & MOUNT ASSEMBLY
SIZE A | DWG. NO. | REV A
SCALE: 1.5 | SHEET 1 OF 1

[C]

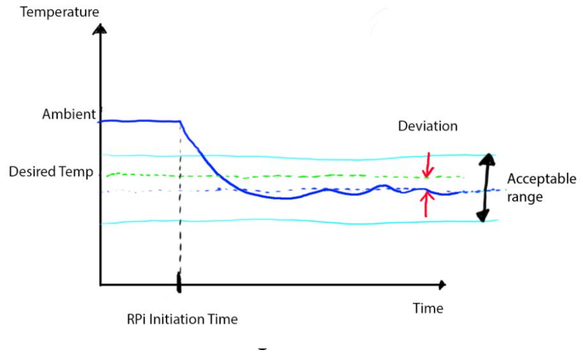


Prototype Concept: Create an easily alterable plate system to test various parameters including *thermal cooling maintained below 20 degrees Celsius, fluid agitation from vibration, and temperature sensor accuracy*.
Multiple thermocouples are applied under the well plate (A8) to measure the temperature at various points on the block (2), our team will be able to determine a sufficient time needed for the liquid in the vials (1) to reach optimum temperature. A feedback loop to control the heating elements (6) output will be used as well to regulate the vials optimum temperature.

Design Parameters

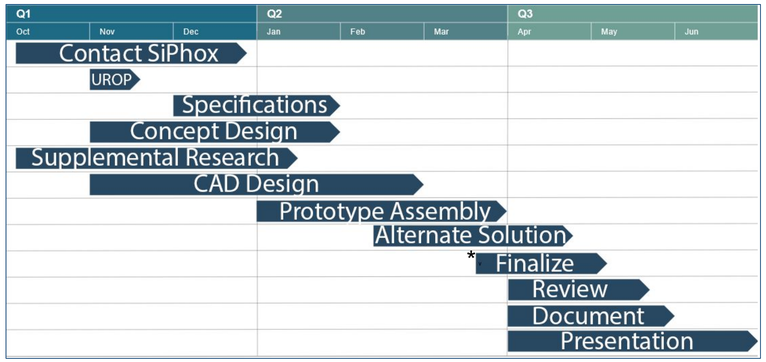
Regulations:

FDA Class I - Immunology and Microbiology Device
IEC 60529 - Degrees of Protection Provided by Enclosures - Applies to our device because it contains electronics and involves the use of liquids such as organic solvents
IEC 60601-1-6 & ISO 14971 - Risk Management of Medical Devices - Addresses the risks of device malfunction or using the device incorrectly
ASTM C680 - Standard Practice for Estimating Heat Loss of Surface Temperatures - Recognizes the design for insulating the designated surface area, then using algorithms to adjust heat transfer to maintain the intended temperature



- **Ingress Protection Rating IPX4** - Water resistance to 10psi streams
- **Support Flexibility** - Allow for cyclic loadings without failure of support members
- **Over-Power Protection (IEC)** - appropriately fuse the electronics in case of water damage
- **Continuously Variable Temperature Control** - ability to autonomously monitor and adjust temperature to fit a time-temperature curve
- **Complete Agitation Time and Rate** - analyze the time it takes for homogeneous mixing at giving motor RPM rates

Projected Timeline



**At this time, our team is set to proceed on the progress for our prototype in Quarter 3*

Contact Information & References

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References

[1] CDC, "CDC COVID Data Tracker," *Centers for Disease Control and Prevention*, Mar. 28, 2020. https://covid.cdc.gov/covid-data-tracker (accessed Mar. 01, 2021).
[2] "How Nanophotonic Label-Free Biosensors Can Contribute to Rapid and Massive Diagnostics of Respiratory Virus Infections: COVID-19 Case | ACS Sensors." https://pubs.acs.org/doi/full/10.1021/acssensors.0c01180 (accessed Nov. 29, 2020).
[3] "U.S. coronavirus cases: Tracking deaths, confirmed cases by state," *Washington Post*. https://www.washingtonpost.com/graphics/2020/national/coronavirus-us-cases-deaths/ (accessed Nov. 30, 2020).