DATE: **February 8th, 2021**

TO: **Dr. Deirdre Hunter**

FROM: **Sindhuja Darisipudi, Nora Han, Joseph Urso, Michael Tang, Jason Ye**

**Team Moonrats (**[**5moonrats@gmail.com**](mailto:5moonrats@gmail.com)**)**

SUBJECT: **Water Assessment Incubator Problem Statement and Team Structure**

**Design Problem Context**

Water sanitation is a crisis affecting 780 million people around the world, many of whom live in underprivileged and remote areas. This problem is exacerbated because not all water potability tests (i.e. tests that indicate if water is drinkable) are practical in such settings, as many rely on access to laboratories. One method that does work is via Petrifilms, a culture-based method for detection.

Culture-based methods for the detection of microbial contaminants are the state-of-the-art for water quality analysis in both industrialized and developing countries. Microorganisms exist in many environments and require different temperature conditions for optimal growth. Therefore, creating a temperature-stable incubation environment is a precondition for the reliable detection of microbial contaminants of concern in drinking water. By applying water samples to these Petrifilms and incubating them for 24-48 hours, one can visually inspect for E. coli contamination.

Hence, our task is to build an incubator for the Petrifilms that is suitable for water sanitation tests in these remote areas. Our main design criteria in accomplishing this, as discussed with our client, include small size, ease of use, and data logging capabilities, as elaborated in our problem statement.

**Current Design Flaws and Future Solutions**:

1. **Design solution:**

A portable, low-cost incubator for holding petri films will be designed by our team.

*Designed for*: Public Invention, as a part of an initiative to help monitor water quality in remote settings.

*Used by*: On the ground experts in remote and low resource settings

1. **Limitations of existing solution**

In order to monitor water quality in remote & low resource settings, a portable incubator is needed to be transportable, as on the ground workers will often be going from location to location

The existing solution has the limitations of:

i. not providing enough information about the inside temperature to monitor the growing environment of the microorganisms.

ii. not being small enough

1. **Potential design solution features**

A portable (< 38cm×24.5cm×19cm (dimensions of existing design))\*, low-cost (under $500) incubator to hold 20 small petri film (3x4 inches) which has:

**i.**  the ability to provide a constant elevated temperature between 30ºC and 42ºC, as this is the ideal incubation temperature for the petrifilms

**ii.** a data tracking and digital readout of temperature

**iii.** rechargeable primary cells that could last the duration of one incubation cycle (up to 48 hours) per one charging

**iv.** be able to work with minimal repairs for upwards of 3 years

If possible, we would like to have it the following features:

**i.**  A warning mechanism to indicate if the system has failed, the battery is low, or if the temperature has fluctuated out of range.

**iii.** humidity control inside of the incubator

*\*client wants it to fit in a backpack.*

**Team Structures and Activities**

Over the course of the Spring 2021 semester (beginning January 25th, 2021 and ending May 14th, 2021), Team Moonrats will produce a prototype, 9 technical memos, and a final design accompanying the final prototype. Table 1 outlines the authors of each technical memo, and the date by which we plan to finish them. Table 2 outlines other major deliverables and an estimate of when we would like to finish them by.

We will produce our deliverables within a $500 budget that has been allocated to our team. In order to meet our goals within the given time frame, we will meet weekly on Tuesdays from 7:00pm - 8:00pm. Below, Table 3 and Table 4 list the contact information of the members and affiliates of Team Moonrats.

**Table 1: Tech Memo Author Table**

| **Tech Memo** | **Finish By** | **Authors** |
| --- | --- | --- |
| TM1: Problem Statement | 02/08/2021 | All team members |
| TM 2: Need-to-Know List and Bibliography | 02/15/2021 | Michael & Joseph |
| TM 3: Design Criteria | 02/19/2021 | Jason & Nora |
| TM 4: Brainstorming of design solutions | 02/22/2021 | Sindhuja & Michael |
| SM 10: Team Pit Stop Reflection | 02/22/2021 | Everyone individually |
| TM 5: Evaluation of Design Solution | 03/02/2021 | Joseph & Jason |
| TM 6: Design Plan | 03/08/2021 | Nora & Sindhuja |
| TM 7: Gantt Chart | 03/22/2021 | Michael & Joseph |
| SM 11: Identity Reflection | 03/29/2021 | Everyone individually |
| TM 8: Testing Plan | 04/12/2021 | Jason & Nora |
| TM 9: Design Solution | 05/05/2021 | All team members |
| SM 12: Team Post Mortem Reflection | 05/07/2021 | Everyone individually |

**Table 2: Major Deliverables and Planned Completion Dates**

| **Task** | **Planned Completion Date** |
| --- | --- |
| Initial Low Fidelity Prototypes | 1st Week of March |
| Final Low Fidelity Prototype | 2nd Week of March |
| Select Design & Order Materials | 3rd Week of March |
| Final Design & Prototype | Late April |

**Table 3: Team Members and Contact Information**

| **Team Moonrats** | | |
| --- | --- | --- |
| **Name** | **Email** | **Phone Number** |
| Joseph Urso | [jru1@rice.edu](mailto:jru1@rice.edu) | +1 (832) 496-4116 |
| Jason Ye | [jy76@rice.edu](mailto:jy76@rice.edu) | +1 (832) 245-6714 |
| Sindhuja Darisipudi | [sd87@rice.edu](mailto:sd87@rice.edu) | +1 (972) 662-8299 |
| Michael Tang | [mjt6@rice.edu](mailto:mjt6@rice.edu) | +1 (713) 349-3952 |
| Nora Han | [th42@rice.edu](mailto:th42@rice.edu) | +86 131 4118 1917 |

**Table 4: Clients, Sponsors, and Other Affiliates and Contact Information**

| **Name** | **Role** | **Email** |
| --- | --- | --- |
| Dr. Christopher Ferguson | Client | [cfergu11@gmail.com](mailto:cfergu11@gmail.com) |
| Dr. Ashley Taylor | Faculty Sponsor | [art6@rice.edu](mailto:art6@rice.edu) |
| Scott Lin | Design Mentor | [sl105@rice.edu](mailto:sl105@rice.edu) |
| Cat Grasso | Writing Mentor | [cg39@rice.edu](mailto:cg39@rice.edu) |

**Works Cited**

“Global WASH Fast Facts.” *Global Water, Sanitation, & Hygiene (WASH)*, Center for Disease Control and Prevention, 11 April 2016, https://www.cdc.gov/healthywater/global/wash\_statistics.html. Accessed 5 February 2021.

Mistry, Pratibha, and Jessica A. Lawson. “Testing water quality: When labs don’t work.” *World Bank Blogs*, World Bank Group, 24 January 2017, https://blogs.worldbank.org/water/when-labs-don-t-work. Accessed 7 February 2021.

Schertenleib, A., Sigrist, J., Friedrich, M. N. D., Ebi, C., Hammes, F., Marks, S. J. Construction of a Low-cost Mobile Incubator for Field and Laboratory Use. J. Vis. Exp. (145), e58443, doi:10.3791/58443 (2019). Accessed 7 February 2021.