

Alkalinity Titrator

Open Acidification Project
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ABSTRACT

As climate change continues to worsen, the importance of ocean acidification research increases. alkalinity titrators are a necessary tool in ocean acidification research, however, the high costs for equipment and the long time it takes to perform these titrations often slows research progress. The Open Acidification Alkalinity Titrator Project was started by Dr. Onthank and WWU students who worked to create a low-cost alkalinity titrator. The goal of this project is to continue their work by integrating a user interface, automating the titration process, and creating a graphical user interface for future developers. With this new iteration of development, the alkalinity titrator will further decrease the barrier of entry for ocean acidification research.

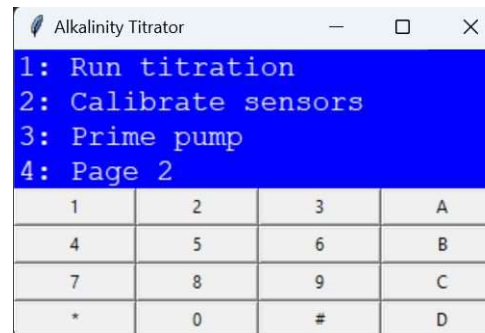
INTRODUCTION

The alkalinity titrator is an ongoing project for Dr. Onthank and the WWU Biology Department. The goals of this project were to integrate a User Interface design with the alkalinity titrator's physical hardware. In addition to implementing the UI on the physical device, a GUI was developed to allow ongoing development of the project by those who do not possess the physical device. This GUI functions as a simulated Titrator with mock devices, allowing a developer to step through the different menus and titration routines on their computer. This development will enable contributions by those who previously could not due to the inability to work with the physical hardware.

Graphical User Interface

The graphical user interface was created to simulate the same display and keypad as the physical alkalinity titrator. The GUI operates alongside the alkalinity titrator allowing the mock titrator to continue running in the background as the key presses occur asynchronously.

This design was possible through the use of multithreading. The titrator uses a driver function to maintain a continuous loop and updates the titrator each iteration through the loop. Before the driver starts, a separate thread is created in which the GUI exists. The titrator continuously updates itself until the GUI experiences a key press. Upon a button press, the value from the button is passed to the titrator and is updated appropriately.



The titrator's main menu displayed in the GUI

The GUI's ability to operate outside the alkalinity titrator, allows the mock device to continuously update without user input. This ability allows the simulated titrator to mimic the behavior of the real alkalinity titrator.

User Interface Integration

At the start of this project, the device existed largely disconnected from the UI State Machine that was created to improve upon the original design and more closely match the design patterns of the Open Acidification Tank Controller. Throughout this project, each peripheral device and their subroutines have been integrated and tested with the new UI State machine design. These devices would include the titrator's temperature and pH probes, the heating element, the syringe pump, the stir controller, as well as the LCD and keypad.

Conclusion

While the basic functions of this device are in place, development is still needed to achieve the goal of performing fully automated titrations. With the addition of the integrated UI state machine and the graphical user interface, the work needed to achieve this goal has been significantly reduced. Developers will now be able to easily make changes to the alkalinity titrator's code and see how those changes are implemented without needing the physical device. This will allow more individuals to contribute to this project, at a higher rate than before.

REFERENCES

- <https://open-acidification.github.io>
- <https://github.com/Open-Acidification/AlkalinityTitrator>