pFIONA Programmable Flow Injection Ocean Nutrient Analyser

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Project Sponsor: Moss Landing Marine Lab

BACKGROUND AND MOTIVATION

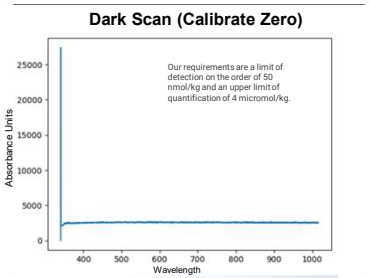
- Analysis of Phosphate (PO4) as an Indicator of Eutrophication
- **Quantify** Agriculture Impact on Ocean Nutrient Levels
- Reduce Energy Use and Overall Cost of pFI Analysis
- Democratize pFI Analysis of Water Samples
- Produce Higher Resolution Time & Location PO4 Analysis

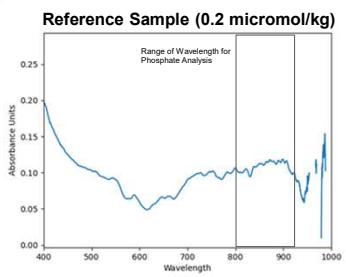
OBJECTIVES

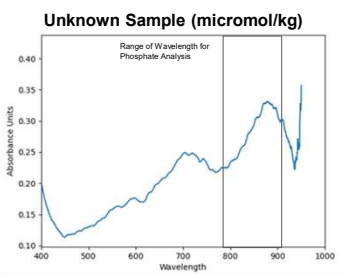
- Reverse Engineer Lab-Based Instrument **Sans Software**
- Deployable, Wireless, Remote, and Realtime pFI Analysis
- Withstand Exposure to Wet, Salt Air Environments
- Watertight Housings for Components and Reagents
- Develop and Test Firmware, Software, Enclosure, & Housing
- Integrate Auxiliary Pump and Light Source Into Enclosure

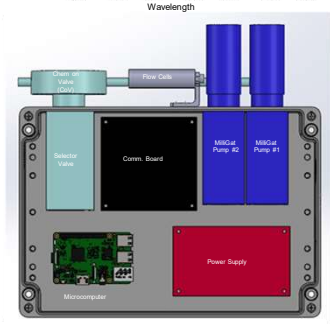
METHODS

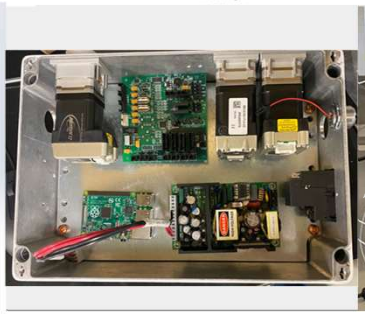
- Raspberry Pi Controlled System Using Python, IOT
- Control 3 Nema 17's Via Serial to RS485 Bridge
- 3D Modeling Enabled Iterative Design Prior to Manufacturing
- **Rapid Prototyping** Utilizing 3D Printing and CNC Machining
- Research, Documentation, SolidWorks, Orcad, Github
- Benchtop Prototype Allowing Iterative Testing & Development
- 3D Models of Components + 3D Printed Hole Patterns
- Trial and Error, Debugging With Users

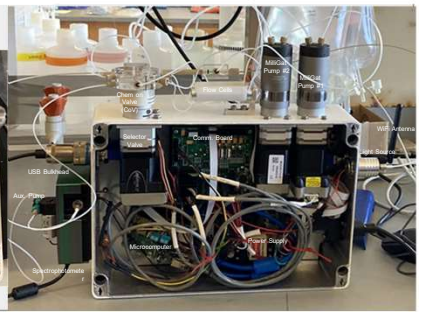












RESULTS AND LESSONS LEARNED

- Wireless, Deployable, Splashproof Instrument Accessible Via Internet
- Design Specifications Hierarchy Determined By Environment & Process
- Interfacing With Linux Based Systems & Developing Firmware
- Soft Skills Interfacing With Cross Discipline Users, Advisors, Researchers
- Automating Microfluidic Handling Using Python Scripts
- Understanding of Serial and RS485 Communication Standards
- Leveraging 3D Printing, Iterative Design, and Off-The-Shelf Components

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