Vertical Profiling Float

The vertical-profiling float serves as a float that can perform vertical profiles and transmit data to and from a base station after being deployed by the ROV. It utilizes a buoyancy engine to control the displacement of seawater and thus control the vertical height of the float. This buoyancy engine consists of a syringe actuated by the linear actuator controlled through an H-bridge by the Arduino Nano. In combination with neutrally buoyancy calibration at the 70mL mark of the syringe, this leads to sinkage when the syringe is retracted and flotation when the syringe is extended. Onboard the float also contains a RTC module which keeps track of the current UTC to be sent to the base station controller via a radio module. This radio module uses the LoRa protocol to send data on the 915.0 MHz radio channel per federal regulations for unlicensed radio usage.

Using the knowledge gained from last year's float, I wanted to create a smaller, more robust, and elegant solution. This solution replaced the unreliable float bag powered by compressed air with a syringe driven by a repeatable linear actuator inspired by the CityU Underwater Robotics Team's float from 2022. In addition, a more reliable enclosure utilizing O-ring seals replaced PVC tubes with screw-on caps. Concern arose about how long the new float would take to rise/sink. However, a Python script estimated the time to surface to be 20 seconds in a 6-meter-deep pool which eased our concerns and thus we proceeded with the build. After numerous challenges including epoxy leaks, broken parts from drops, and incorrect 3D print tolerances, the float was finished.

Numerous safety precautions were made. Firstly, per ELEC-NRD-004, batteries were limited to two 9V batteries under the 12V limit. Fuses were also calculated (per 3.3.3 Current) and installed within 5cm of the battery-positive terminal. The battery container was designed to release pressure with a pressure release valve (approved by the Competition Technical Manager) and a Schrader valve. Batteries are also securely attached via tape. All general safety guidelines such as no sharp edges were also followed.

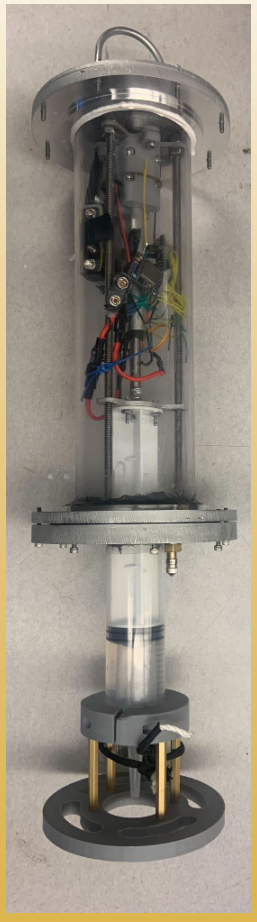


Fig. 1 - Assembled Vertical Profiling Float

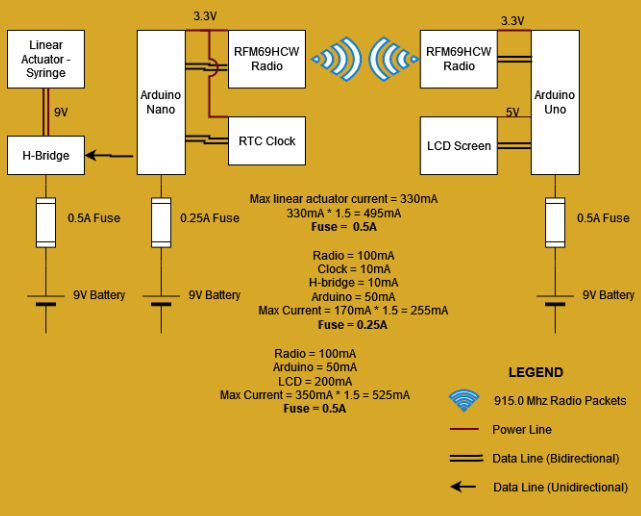
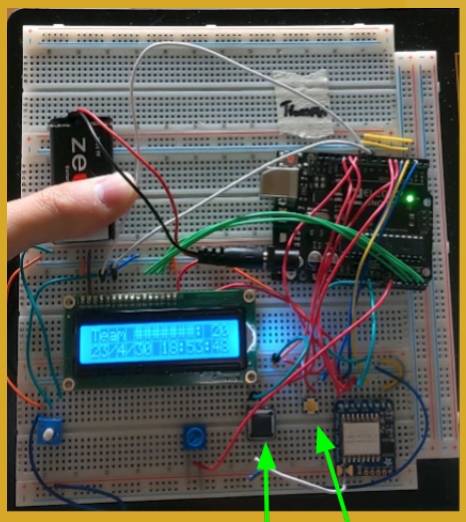


Fig. 2- System Intergration Diagram of the Float



Operation Guidelines

0. Float calibrated to neutral point per "Reset PB" press in 60 seconds.
1. "Start PB" pressed when "Float Mid" no longer on LCD to start a vertical profile.
2. 80 seconds later, vertical profile complete and team number with UTC is displayed on LCD.
3. Repeat steps (1) and (2) for 2nd vertical profile.

Fig. 3 - Operation Guidelines and Buoyancy Engine