CWRUbotix

2023 Non-ROV Device Design

UN Decade of the Ocean: MATE Inspires ESG

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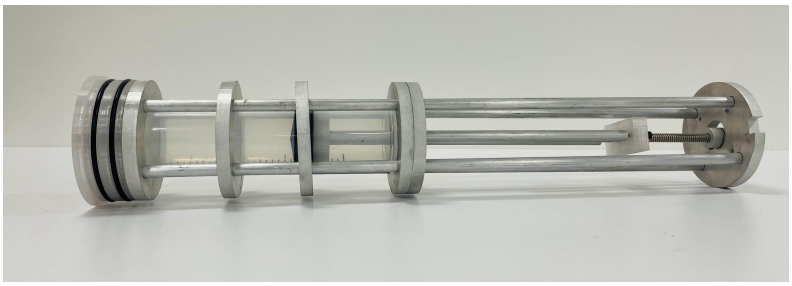
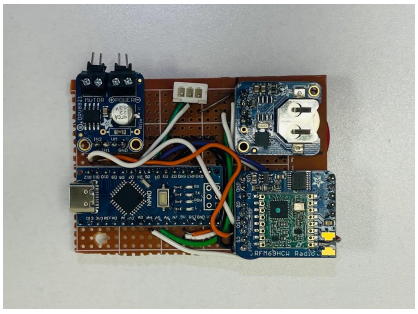


The main body of our vertical profiling float is made out of high-pressure hard polycarbonate tubing with four 6061 aluminum support rods, two end caps with two o-rings each, and 6061 aluminum support plates throughout the tube. Our buoyancy engine has a syringe attached to two plunger rods with a brass nut that is driven by a lead screw attached to our motor.

The profiling float's profiles are based on experimental timing to minimize the sensing electronics needed on board and hence complexity. The float has a total volume of 5097±150 cm^3, and so its dry mass is 5.097 kg in order to achieve neutral buoyancy in water. The buoyancy engine thus provides 0.150 kgf, or about 1.47 N, in either direction to either ascend or descend in its vertical profiles.



An Arduino Nano in the float controls a small brushed DC motor which drives the buoyancy engine. Two limit switches placed on either side of the syringe allow the Arduino to sense when the syringe is at either of its extremes. Additionally, an I^2C RTC module keeps track of the current UTC time and an SPI 900Mhz transceiver module from Adafruit transmits the data to the control station. The clock and transceiver were both chosen for their ease of implementation and the transceivers' use of the 900Mhz band, which allows for legal unlicensed broadcasting. The transceiver communicates with a corresponding Arduino/transceiver unit on the surface as it completes the vertical profiles. A simple H-bridge board was used to switch the direction of the brushed motor. The electronics are powered by 8 AA batteries.

An Arduino Nano tethered to the surface computer via a USB cable receives commands from a ROS node over serial, then broadcasts these commands to the Arduino on the float via the RadioHead RF69 library. The Arduino aboard the float listens for a command to submerge, then begins performing automatic vertical profiles. At the top of each profile, the float Arduino broadcasts our team number and the time according to its RTC module. The shore Arduino receives this information and communicates it to the surface computer via serial.