Ground Truthing the Chesapeake Bay: Developing a Remotely Operated Vehicle With Water Sampling Capabilities

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Citizen science programs rely on volunteer collected data to assist in ground truthing of satellites. Ground truthing is comparing field samples with remotely sensed data from a satellite for accuracy. Access to a boat or dock and seasonal constraints prevent volunteer participation. We developed a remotely operated boat that collects water samples aimed to increase sampling access. The boat was developed in several stages resulting in a 3D-printed design operated with microcontroller electronics. The boat is operated remotely using radio connections. It is propelled with brushless motors and water is collected through a peristaltic/vacuum pump. Milliliters (mL) of water collected, distance traveled in meters (m), time to collection (minutes:seconds), and GPS location were logged respectively for each trial. The remotely operated boats' capabilities were tested in ten trials. The trials were compared against benchmarks and analyzed. 50 mL of water was collected for each trial, matching the 50 mL goal. A mean distance of 28.5 m was reached for each trial, 13.5 m greater than the 15 m minimum. The mean collection time was 5:26. A GPS location was logged for each trial successfully. The experimentation shows that the remotely operated boat we developed demonstrates the ability to collect water samples of 50 mL at a distance greater than 15m and log a GPS location. Our design could be used by organizations to expand collection of water quality measurements. Further development will increase sampling speed, capacity, and range.

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