Testing the Waters: Engineering an Innovative Method of Water Health Analysis, Year II

Cardwell, John (School: Breck School)

Natural and anthropogenic sources pollute lakes and rivers worldwide, endangering freshwater supplies. To address water-related problems, physical sampling and data collection are required. Current methods of manual water quality evaluation are time-inefficient and expensive. The focus of this research was to design a remotely operated system to monitor the health of lakes and rivers. It consisted of two parts: 1) a quadcopter drone to collect aerial imagery, and 2) a remote-controlled watercraft to collect physical samples and electronic data. Aerial photos captured using a DJI Mavic Air 2 drone were analyzed for color, and drone video was used to 3D render topographic maps. The drone was also used to document progression of an algae bloom. A portable remote-controlled watercraft was fitted with a water-sampling system. This system utilized 1) vacutainers (traditionally used for blood collection); 2) an attachment chain fitted with 3D printed vacutainer retention; and 3) a linear actuator articulating a needle to puncture. A prototype vacutainer sampling system was constructed in year one, but the design was refined in multiple areas: 1) the mounting plate was completely redesigned; 2) a second plate was added to properly tension the chain; and 3) a more effective puncture mechanism was implemented. To the authors' knowledge, the remote-controlled mini-watercraft engineered in this study is the first to employ vacutainers in water collection. When ultimately operated in concert, the mini-watercraft/drone system could gather detailed, comprehensive data on physical and chemical aspects of a body of water, facilitating economical management of limited freshwater supplies.

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