The Design and Engineering of an Intelligent Remotely Operated Vehicle for Coral Reef Research and Monitoring

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Coral reefs are a vital ecosystem that thousands of species rely on. However, with climate changing, coral reefs are struggling. The “Cnidaria” Project serves as a tool for scientists to accelerate the collection and analysis of data – supporting the protection of coral reefs. Cnidaria incorporates an ROV with computer vision, CTD sensors, and a water sampling system. “She” would be used by limited-resource institutions because of her relatively low cost, ease of transport and operation, and modular platform. To prove her usefulness, Cnidaria v1 should have a model that can ID different species and anomalies, accurate CTD sensors that log data, and a functional water sampler. For determining model accuracy, the percent error of true-positives and the average confidence were calculated both with images and live video. The CTD sensors were compared to calibration solutions and other same-model sensors. The success ratio across nine attempts was calculated for the water sampler. Results demonstrated each system was often successful. The CV system had a confidence of 63.3% with still images. It also had an accuracy of 62% with live video, demonstrating it requires continuous training for higher accuracy. The CTD sensors showed direct correlation with other sensors and the calibration solutions, and the water sampler was successful 9/9 times. Though not every feature was achieved for v1, such as data logging or anomaly detection, these findings prove that this could be a valuable and reliable tool for coral scientists, especially as Cnidaria continues to expand.

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