WAL-SEA: Development of a Homebuilt, Multifunctional Remotely Operated Vehicle for the Study of the Near-Shore Ocean Ecosystems

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95% of the giant kelp forests along California coastlines have been devoured by the overpopulated purple urchins, and the current solution of relying on divers to reduce urchin numbers is laborious and inefficient. There is an urgent need to develop an ROV system to study near-shore ocean ecosystems. WAL-SEA consists of two modules: a survey and vacuum module. Seven trials at Del Monte Beach at 40-60 feet deep were conducted to optimize my ROV system. Two sets of experiments were conducted underwater: urchin density mapping and urchin collection. The survey module recorded an area and collected footage for plotting urchin densities to identify high-density areas for remediation. The vacuum module then collected urchins, utilizing an 8-second pulsing function that made collecting urchins more efficient. While WAL-SEA's 300 urchins/hour rate is slower than divers, WAL-SEA can be deployed multiple hours, any day throughout the week, and can collect 20x more organisms weekly than divers. In this research, I successfully developed WAL-SEA, an underwater ROV capable of carrying out a multitude of functions for near-shore oceanic ecosystem applications. It is capable of surveying a target area 4x faster than a diver and culling overpopulated species more efficiently than the current manual approach of having divers perform pre-surveying and culling. This is the first demonstration of an integrated vacuum module with a ROV system traditionally used for surveying. WAL-SEA has immediate applications such as reducing overpopulated organisms, tracking migration patterns of underwater species, monitoring restoration of endangered organisms, and cleaning invasive species.

Awards Won:

National Oceanic and Atmospheric Administration - NOAA: Science Communication Award

International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention, a 1-year free student membership to the INCOSE, and free virtual admission to the 2022 International Symposium of the INCOSE