WAVER - An AI-Powered Autonomous System for Hypoxic Zone Remediation and Marine Ecosystem Restoration

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Aquatic hypoxic “dead zones,” where dissolved oxygen levels drop to critical levels, are becoming more frequent due to pollution and climate change. These conditions threaten aquatic life, reduce biodiversity, and impact economic activities that depend on healthy water systems. This project presents WAVER, an autonomous under/on water drone designed to both detect and reduce hypoxic conditions through targeted water mixing trough waves witch enhance water circulation and oxygenation. WAVER is equipped with a set of water quality sensors that measure dissolved oxygen DO, temperature, pH and poluant concentration in real time. The system uses these measurements to identify areas where hypoxia is likely to occur, the system generate localized turbulence, improving water circulation and helping redistribute oxygen. In addition the system incorporates AI-based environmental sensing, using AI-powered data analysis, Waver processes this information in real time to deliver predictive insights and detailed environmental reports detecting oil leakage, plastic waste and to identify pollution events and areas of ecological stress, then displayed on data plateform. As an autonomus contrôle system, Waver follows disturbances in aquatic habitats. The system was tested in controlled aquatic environments simulating hypoxia. In these conditions, WAVER increased dissolved oxygen levels by 25% within 30 minutes. While these results are promising, further work is needed to evaluate energy efficiency and performance in natural environments. Overall, this project shows that autonomous systems can play a dual role in both monitoring and improving water quality. WAVER offers a potential approach for managing hypoxia and supporting the protection of aquatic ecosystems at larger scales.

Awards Won: