

Storm Surge Aftermath: Inspection and Cleaning of Marine Infrastructure

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Abstract

Storm surges damage marine infrastructure, leaving surfaces covered by sediment, debris, and hard biofouling. Traditional manned diving is risky and inefficient. This project develops a compact ROV with strong hard-fouling removal, equipped with cameras and sensors. It cleans thick fouling to expose concrete spalling, exposed steel, and cracks, providing a safe and efficient visual pre-inspection method.

Results and Discussion

The ROV effectively removes thick fouling to reveal damage. It cuts operation time sharply, eliminates diver risks, and is eco-friendly. It works in turbid water via human-robot collaboration. High-pressure jet expose deeper damage; wheel slip can be fixed by rubber treads. Operation parameters need adjustment for different surfaces.

Conclusion

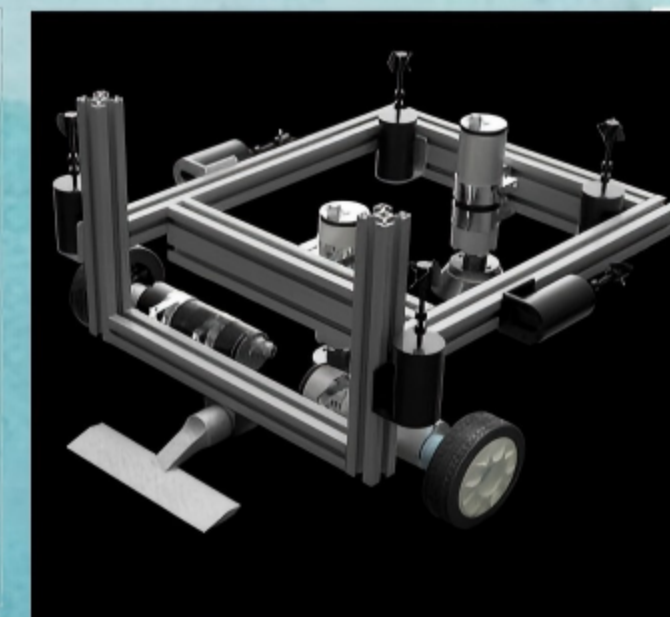
The compact ROV is feasible for post-storm cleaning and damage assessment. It safely removes attachments to expose structures, supporting repair. It equips the team with integrated underwater engineering skills and provides ports, bridges, and wind farm units with a low-cost, rapid-response tool, shortening channel closure, and ensuring public safety.

Research Background and Objectives

Extreme storms intensify, harming marine infrastructure. Fouling blocks damage assessment. Manual diving has high risks and causes pollution. Existing equipment is unsuitable for complex surfaces. This project aims to replace manual work with a compact ROV to clean and inspect safely and efficiently.

Research Methodology

Based on compact ROV hull-cleaning tech, modified for vertical, sloped, and curved surfaces. Adopts wheeled drive for narrow access and simplified structure. Optimized for local directional cleaning; adds modular collection to avoid secondary pollution. Uses corrosion-resistant body, short-range high-pressure water jet, high-torque mechanical cleaner, underwater camera, and sensors.



1.1 # Motor Interface Control Signal Logic			
0	0	x	Brake
1	1	x	Floating
1	0	PWM	Forward Speed Control
0	1	PWM	Reverse Speed Control
1	0	1	Full Speed Forward
0	1	1	Full Speed Reverse

2.2 # Motor Interface Control Signal Logic			
0	0	x	Brake
1	1	x	Floating
1	0	PWM	Forward Speed Control
0	1	PWM	Reverse Speed Control
1	0	1	Full Speed Forward
0	1	1	Full Speed Reverse

Workflow

Deploy ROV and attach to the surface via reverse thrust
High-pressure water jet flushes sediment
High-torque unit removes hard fouling
Real-time video transmits for damage marking.

Future Plans

Conduct pilot tests with enterprises; integrate positioning and navigation for auto-planning; develop AI damage recognition. Explore large-debris removal and strong-current stability solutions.