

EcoMarine: Smart Boat for Plastic-Free Waters

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Abstract:

This project conceives of a low-cost, AI/ML-capable robotic boat specifically designed for autonomous waste collection and pollution removal from oceans and rivers. The boat possesses a computer vision system driven by AI that is capable of detecting and classifying various types of trash—floating wreckage, plastic bottles, and natural debris—on the fly. Navigation is enhanced through machine learning algorithms that process environmental data such as waste concentration, water currents, and hazard. This enables the boat to dynamically adjust direction, optimize efficiency, and cover waste areas. The system is self-contained, reducing the amount of human intervention and delivering a smart, data-driven solution to ocean cleanup.

Besides waste collection, the boat also integrates advanced pollutant-removal technologies, including oil-absorbing sponges to control surface oil spills and fine microplastic filters to eliminate poisonous, invisible particles. With a modular construction, the boat allows for ease of maintenance, component replacement, and scalability on various water bodies such as lakes, rivers, ports, and city canals. The functionality is complemented by renewable energy sources such as solar panels and real-time monitoring via IoT connectivity. Utilization of Industry 4.0 technologies, the robotic boat employs automation, data analytics, and intelligent decision-making to provide a scalable and sustainable solution to water pollution. Not only is this project focusing on environmental problems but also advocating for clean and healthy environments for future generations.