Autonomous Artificial Intelligence-Based Monitoring Device for Monitoring the Deep-Sea Coral Restoration Process

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Deep-sea coral restoration efforts currently suffer from a 65% failure rate, primarily due to inefficient, delayed, and high-risk monitoring techniques. To address this, we developed DEEP (Deep-sea Ecosystem Evaluation Platform)—a compact, autonomous system capable of real-time monitoring at depths of up to 11,000 meters. DEEP features a custom multi-sensor probe (measuring pH, salinity, temperature, dissolved oxygen, and calcium carbonate), acoustic data transmission, and a hybrid power system sustained by betavoltaic energy and supercapacitors. The device is enclosed in a pressure-resistant titanium housing with integrated UV-C biofouling prevention and sapphire ports. Through multiple design iterations guided by biologists, ocean engineers, and communication specialists, we refined DEEP for functionality, durability, and scalability. Projected to reduce monitoring costs by over 90% and increase coral survival rates to more than 50%, DEEP offers a transformative leap forward in sustainable ocean restoration. DEEP is not just a device—it's a scalable leap toward sustainable ocean recovery.

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