Ocean Guardian Final Design Project Summary - Group #25

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Project Overview

The Ocean Guardian describes a suite of solutions aimed at combating the effects of (micro)plastic pollution on large marine life. The product will contain a suite of 3 solution areas: a fleet of autonomous trash cleaning robots, areas for these robots to dock and handoff critical analytic data, and a dashboard solution to display different metrics related to ocean water quality and general trends. In theory, this suite should bridge the gap between the work done on polluted ocean areas, and the concrete evidence that that work is positively affecting the ocean life there.

Stakeholders/Customer Base

The primary client for this project will be the World Wildlife fund. Their primary mission is to reduce humanity's environmental footprint, which this project actively works towards. They will provide guidance in the development of Ocean Guardian, ensuring it will work at maximum efficacy and efficiency to reduce the amount of human waste found in the world's oceans. Members of the Ocean Conservancy, an organization based in the United States that is committed to protecting the ocean through addressing ocean pollution and climate change, will be the primary hands-on users of the product. Marine biology research hubs will also be given access to the units of Ocean Guardian for research purposes. A team of marine operation technologists, field technologists, data technicians, and marine robotics technicians will work to ensure unit deployment, proper operations, and routine maintenance/repairs. User feedback from the Ocean Conservancy members and researchers will be taken into consideration for refining the product during its iterative development. The stakeholders given highest priority in this product launch are the World Wildlife Fund and the Ocean Conservancy organizations.

Constraints

The units must function safely and efficiently across diverse marine environments with varying weather, salinity, debris, waves, etc. Hardware durability, unit waterproofing, corrosion resistance, and minimal environmental impact towards the marine ecosystem are pertinent constraints in this project. Units will operate autonomously from a ship-based control center. The system must be able to integrate existing software/marine data networks that contain information regarding ocean conditions. Maintenance and repair operations will occur in designated workshops with specialized tools for unit servicing. Following the 36 month period of prototyping and iterative development, full scale production of multiple units of Ocean Guardian is expected to take 3 years.

Functional Requirements

The system must collect, process, and transmit marine environmental data from remote units to a central database in real-time or near real-time. It must support automated alerts for abnormal

readings and allow authorized users to view, analyze, and export data via a secure web-based dashboard. The system must also enable remote configuration and diagnostics of deployed units, integration with third-party marine data APIs, and automated report generation based on predefined environmental metrics.

Operational and Environmental Requirements

The units must be designed to withstand the variable, harsh marine conditions. This includes saltwater corrosion, strong waves, extreme temperatures, etc. They must withstand these conditions for years without failure. The system must successfully interface with external marine data networks and APIs to ensure accurate predictive modeling. The product must come as a modular kit for straightforward “assembly” and deployment. The hardware and software must be released as compatible bundles to prevent mismatching and instability.

Security Requirements

The system must be secured through role-based access control and multi-factor authentication to ensure only authorized personnel can access specific data in the system. This prevents unauthorized control of the units or unauthorized access to sensitive data/information. All of the data transmitted across the units and the system will be integrity checked to prevent corruption.

Usability Requirements

The product must be user-friendly and intuitive to new and returning users. It will allow new users to navigate the dashboard and perform tasks with ease within 15 minutes, supported by clear and non-ambiguous alerts/notifications. It must be adaptable for international use with all units of measurement with correct and consistent conversions. It must be accessible to authorized users with visual impairments via text-to-audio functionality. Comprehensive user documentation and manuals are required in the product bundle. Role-based training and demonstrating mastery through passing a practical exam will ensure that personnel are able to operate the system safely and effectively.

Legal Requirements

The product must operate legally and safely by obtaining all the necessary environmental environmental permits, strictly adhering to the International Maritime Law for collision avoidance. It must conform to industry standards for hardware durability (i.e. IP68 rating) and modern cybersecurity protocols for data encryption.

Success Criteria

The success criteria will be defined based on the amount of animals successfully rescued from life-threatening situations as a result of large trash accumulations. Data from our autonomous robots will accurately measure the project's success by pinpointing the total amount of trash collected.