

# Hong Kong Student Science Project Competition 2022

Team Number: SCPE220

Project Title: Submerged Cyborg

Project Type: Invention Design Proposal

To our best knowledge and after thorough literature research, as at 28 / 6 / 2022 , there are similar works. The reference links are as below:

Zahugi, E. M. H., Shanta, M. M., & Prasad, T. V. (2012). Design of multi-robot system for cleaning up marine oil spill. *International Journal of Advanced Information Technology*, 2(4), 33.  
Hong, L., Cui, W., & Chen, H. (2021). A Novel Multi-Robot Task Allocation Model in Marine Plastics Cleaning Based on Replicator Dynamics. *Journal of Marine Science and Engineering*, 9(8), 879..  
Akib, A., Tasnim, F., Biswas, D., Hashem, M. B., Rahman, K., Bhattacharjee, A., & Fattah, S. A. (2019, October). Unmanned floating waste collecting robot. In *TENCON 2019-2019 IEEE Region 10 Conference (TENCON)* (pp. 2645-2650). IEEE.

The enhancement our project has made for the existing related products or research is summarized as below:

**Multi-Robot system for Cleaning up Marine Oil Spill-** In the research, a multi-robot system is used for cleaning up oil spills. Our proposal only adopts the idea of using a multi-robot system, but the actual design of the robot is drastically different in both its purpose (cleaning up plastic wastes instead of oil spillage) and mechanism.

**Multi-Robot Task Allocation Model-** In the existing research, a multi-robot underwater cleaning robot is proposed. Our proposal adopts the idea of using a hub and robot system. However, in our proposal, the robots and hubs are planned to be operated along major ocean currents on the surface, instead of it being underwater. Image recognition and other IoT technology are also used for our proposed design

**Unmanned Floating Waste Collecting Robot-** This research details a single robot design for collecting ocean trash using a bluetooth control system. Our proposal expands this by using a radio system in order to increase the range, while also including more than one robot and machine learning technology in order to increase the efficiency and scale.

## I. Background

Marine pollution (or ocean pollution) occurs when chemicals or trash enters the ocean and damages it. It is estimated that 8 million tons of plastic enters the ocean each year, causing 100,000 marine animals to die. Hundreds of marine species are harmed by marine debris, coming mainly from agricultural runoff, untreated sewage, and discharge of nutrients and pesticides. Consequently, this has resulted in more than 400 marine dead zones in the world. We are proposing a solution: the 'Submerged Cyborg', which is an effective and feasible solution to alleviate the problem of marine pollution.

## II. Objective(s)

The Submerged Cyborg's main objective is to protect the marine environment, which is crucial for the preservation of biodiversity. By reducing the amount of plastic garbage in the ocean as much as possible, less marine animals will be harmed. In order to preserve biodiversity, it's crucial to stop the decline in the population of marine species that are in danger of extinction, for example, the Chinese White Dolphin. This is essential in maintaining a clean and sustainable food supply. Seafood is one of the main sources of sustenance for people, as it offers a variety of nutrients. Marine life will, however, consume the waste, which primarily consists of plastic, as a result of ocean pollution. The marine life cannot digest this plastic waste and may perish as a result, severely reducing the availability of seafood.

## III. Methodology

Experimentation is the chosen method for gathering data for this project's deeper research on feasibility. The experiment will be conducted in three locations—the ocean close to the shore, along major ocean currents, and rivers — to make sure the robot can cover the majority of the marine region. The key component of river testing is observing the impact of often changing environments. For sea testing, it is aimed to observe the impact of human activity (boats) or marine life on the water (whether the marine life will see them as targets or falsely eat them).

#### **IV. Design of Invention**

First, Submerged Cyborg consists of a large number of little, independent robots. The robots will each work as a separate unit to gather surface marine plastic debris. However, if larger plastic wastes are found, they can also interact with one another to gather and return it. Submerged Cyborg is made up of individual robots as well as a central center. The goal of the central hub, a floating island, is to process the gathered plastic garbage and serve as a terminal for the robots. The hub will serve as a monitoring and coordination hub as well, allowing the robots to transmit data collected by their sensors. However, because of the ocean currents, one hub can already cover a significant amount of ocean plastic debris. One central hub will span an area of 15 km by 15 km. To improve the effectiveness of garbage collection, Submerged Cyborg also uses numerous algorithms and artificial intelligence technology.

#### **V. Application / Market Need**

The Submerged Cyborg can be used to clean out trash along the ocean current. Environmental protection has been a widely discussed topic recently. Conserving natural resources and protecting natural habitats has become increasingly important, particularly due to the development of technology which has caused heavy pollution and other adverse effects to the environment. Therefore, it is certain that the market demand for environmental protection along the coast is high and that the Submerged Cyborg is a feasible way to address such a worsening issue.

#### **VI. Conclusion**

With the use of this device, we intend to gather ocean garbage that has accumulated on the water's surface. By implementing this approach, we seek to raise awareness of this serious issue, reduce ocean waste, and safeguard coral life and marine species that are in danger of extinction.