Name(s)	Project Number
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Project Title

Keeping the Ocean Clean: A Novel Self-Sustaining Boat that Uses Vision Tracking to Collect and Sort Trash in the Ocean

Abstract

Objectives

Trillions of pieces of trash currently pollute the ocean, which greatly harm marine life and the environment. Our goal is to design, build, and test an autonomous prototype boat that collects and sorts trash in the ocean while being self-sustaining, eco-friendly, having a simple design to minimize costs of production, and having the capability to continually remove trash, including microplastics, from the ocean for years to come.

Methods

Our boat harnesses the natural oceanic forces of currents, winds, and waves to capture the trash in the boat s opening. In addition, the support underneath the boat acts as a stabilizing force that naturally directs the boat towards areas with the highest concentrations of trash. Once the boat collects the trash, a pump sucks the trash from the opening of the boat into the filtering system, while marine life can safely pass beneath the underwater support. Furthermore, a camera uses vision tracking to turn on the pump only when a significant amount of trash is collected, thereby greatly reducing energy consumption. Once the trash is pumped out onto the filtering system, it is then sorted based on size, which makes the recycling process much easier and efficient. Even small plastics are effectively captured by the specially designed microplastics filter. Finally, another camera uses vision tracking to notify when the filtering system is full and needs to be cleaned out.

Results

We designed, created, and tested a prototype of our boat fully equipped with a Raspberry Pi, camera, pump, solar panel, and filtration system. During the entire one week test phase, the prototype boat was self-sufficient and required no external energy source. In addition, the boat collected over 85% of the trash that we placed in our swimming pool, and it accurately sorted this collected trash more than 90% of the time. Furthermore, we tested the camera's vision tracking capabilities: in all 10 test cases, when over 50% of the boat's opening was filled with trash, the pump was properly activated. Finally, we also created a website that raises awareness of ocean pollution and also explains the details of our solution to combat this problem.

Conclusions

Our autonomous boat satisfied all of our experimental goals during the testing phase: it is self-sustaining through the use of solar power combined with minimal energy consumption, eco-friendly by allowing marine life to safely escape the system, has a simple design, and can stay in the water for long periods of time. In the future, after more testing, we plan to create a large-scale version of our boat that will be deployed into the ocean. Furthermore, through our website, we hope to raise awareness of this growing problem and partner with other companies to help deploy these boats all over the world.

Summary Statement

We created a successful autonomous prototype boat that uses vision tracking to collect and sort trash in the ocean while being self-sustaining, eco-friendly, and having the capability to stay in the ocean for long periods of time.

Help Received

We designed, built, and tested the prototype boat ourselves, with the help of the 3D printer and machining tools available at our school.