Developing a Novel Autonomous Robot for Cleaning Oil Spills in Water

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More than 1.7 billion gallons of oil have been spilled since 1940. Oil skimmers are used for the cleanup but today's skimmers require human aid, exposing people to harmful fumes and the risk of violent fires. Therefore the engineering goal was to develop a robotic oil skimmer that would detect and clean up oil as well as avoid collisions, therefore, eliminating the need for human assistance. An initial prototype was made with a polypropylene shell, two propellers, an axial flow pump to suck in oil, and an OV7670 camera module to avoid collisions and detect oil. This design went through the testing process which had three parts. The first part was basic testing. The first prototype failed basic testing because the pump was weak, the battery drained quickly, and the Arduino processed images slowly. Therefore, a new 3-d printed prototype was made which was much lighter, had a Jetson Nano for fast image processing, an ultrasonic sensor for collision-avoidance, and an efficient reciprocating pump. This design passed basic testing. The second stage of testing was collision avoidance, and the robot avoided collisions successfully in 8 out of 10 trials (goal 8/10). Then the next stage of testing was oil detection and cleanup. The robot did this successfully using a machine learning model to detect and clean oil in 7 out of 10 trials (goal 5/10). Therefore, prototype 2 passed the three stages of testing and met the goal of eliminating human assistance through autonomous collision avoidance and oil cleanup.

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