CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

J0319

Project Title

Developing a Multimodal Robotic Scoop

Abstract

Objectives

The goal of my project was to construct a computer-controlled device capable of capturing objects of varying size, shape and texture. My prototype robot, referred to as QuikScoop, consisted of a scooper and retaining basket attached to independent servo motors that could be programmed for a variety of motions. I hypothesized that most objects could be captured using a quick tapping motion but that other modes might be more efficient depending on the type of object.

Methods

I created a scoop and basket device from craft sticks and servo motors. I mounted the device onto a sturdy table-top base able to withstand the mechanical movement of the device. The motors were wired to an Arduino UNO R3 and controlled via USB connection to a computer that ran the corresponding application. The rotation and speed of the motors that controlled the scooper and retainer were programmed from code I wrote in Arduino. By varying the parameters in the code, I learned that simple modifications uploaded to the processor resulted in widely varying motions. This made it possible to develop several configurable modes of QuikScoop to test. I performed multiple tests on various objects, including a ping-pong ball and a Koosh ball. I measured the efficiency of capture in terms of the time between activating the button on the Arduino board to securing the object inside the retaining basket.

Results

Using this method, I found that variations on a basic tapping motion were successful for both test objects. For the ping-pong ball, the most efficient mode for capture was QuikTap, where the speed of the motor was increased just as the servo approached the object, then rapidly returned to its initial position. The most efficient mode to scoop the Koosh ball was QuikFlick, which began with a slow sweep followed by a rapid increase in the speed of rotation just prior to impact with the ball, then a gradual rotation back to the starting position.

Conclusions

Overall, my QuikScoop robot was able to successfully capture objects of different size, shape and texture. My experiments demonstrated that the efficiency of the scooping process was dependent on the physical characteristics of the object and that I was able to program different modes of operation of QuikScoop to explore this. Potential applications of QuikScoop include a robotic aid for disabled individuals to grasp items that are otherwise inaccessible.

Summary Statement

I designed and constructed a robot that could be programmed with multiple configurable modes for scooping small objects.

Help Received

I would like to thank my parents for helping me obtain all necessary materials.