CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
S0314

Project Title
Dexterity of a Soft Robotic Gripper

Abstract

Objectives/Goals
The objective of my project is to investigate how the flexibility of a robotic hand affects its performance in terms of dexterity. The experiment compares a conventional claw gripper and a bio-inspired soft robotic hand for their ability to maintain grip and lift objects of various shapes. The soft robotic hand is made of silicone rubber and operates on air pressure allowing it to inflate and curl around the object it grips. Both the claw gripper and the soft robotic hand are evaluated individually by mounting them upon a 3-axis robotic arm.

Methods/Materials
The Robotic Arm and the claw gripper are built using the parts included in 1.X retail version of the LEGO MINDSTORMS NXT set (8527). The soft gripper is made by pouring a mixture of Ecoflex silicone material into a 3D printed mold and letting it solidify. With an air tube, a hole is punctured at the center of the gripper. The gripper is inflated to curl and grip the objects with the help of a squeeze bulb attached to the other end of the air tube. The materials needed are: Ecoflex 00-30, Ecoflex 00-50, Polaroid Squeeze bulb, polyethylene tubing and a 3d printed mold made of ABS plastic.

Results
The results indicate that the soft robot is adept at gripping curved objects with varying circumference. However, the soft robot could not lift certain objects, such as the small plastic egg, the ruler, and the T.V remote, all of which was held with ease by the claw gripper. The soft gripper could not hold these objects due to their skinny, rectangular nature. The soft gripper's appendages could not curl enough to clasp such objects.

Conclusions/Discussion
The results reveal that the soft gripper is better suited towards holding curved and irregular objects, while the claw gripper excels at holding small or rectangular shaped object. My hypothesis in this experiment was that the soft gripper would outperform the claw gripper in terms of dexterity. My hypothesis was validated, because the soft robot was able to lift the curved irregular objects that the claw gripper could not. The soft gripper could not hold the small rectangular objects because its ability to curl was limited by its larger size. If a smaller version of the soft gripper was made, it would be able to curl around and hold smaller objects. In order to further investigate upon these gripper's uses, further experimentation could be conducted.

Summary Statement
Comparing the dexterity of a conventional claw gripper and a bio-inspired soft silicone gripper that are mounted individually on a robotic arm.

Help Received
Dr.Li of Avid Academy helped me choose the topic; Mr.Ben of Science Buddies helped with trouble shooting while making the soft gripper. My mom helped me get the components and reviewed the report.