

Design and development of a Novel Soft Gripper Manipulated by a Robotic Arm

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Abstract:

This study presents the design and development of a tendon-driven soft gripper manipulated by a 4 DOF robotic arm. The proposed robotic arm and the gripper explore the new areas focusing on increasing the grasping performance of the gripper as well as the workspace. The gripper is designed as a 3 finger and driven by tendons using two servo motors. The tension of the strings is adjusted using a pulley mechanism and a string. The opening and grasping of the soft gripper are accomplished by each motor. The wide opening allows the gripper to grasp wide objects. The parallel robotic arm motion is actuated by 4 motors. Each motor is mounted on a spherical shoulder plate while circular plates with angles axle extrusions are also attached to the motors. The axles are angled so that their axes of rotation converge to the center of the shoulder plate. The vertical and lateral motion of the robotic arm is controlled by the series linkages connected to the axles, thereby actuating the forearm of the mechanism. The robotic arm is 3D printed in polylactic acid (PLA) and the single piece designed soft gripper is 3D printed in thermoplastic polyurethane (TPU). The gripping force applied by the gripper is obtained using flexible sensors attached to the tip of the 3 fingers. The finite element analysis is performed in Ansys and the link lengths are optimized to trace the desired workspace. The mechanism is tested for its grasping and lifting of various objects showing promising superiorities in terms of its grasping capabilities mimicking the human hand. If the robotic arm is mounted on a moving platform, then it can serve as an assistive robot for the elderly.