RESEARCH PROPORSAL

Introduction:

The purpose of this research proposal is to present a comprehensive plan for the design and implementation of a three-finger adaptive gripper with a computer vision-assisted three-finger grasp planner. The proposed system aims to enhance the grasping capabilities of robotic manipulators by utilizing computer vision techniques for object recognition and pose estimation, SolidWorks for gripper design and simulation, and the principles of kinematics of robotics for precise finger motion planning.

Problem Statement:

Efficient and adaptable grasping is a fundamental requirement for robotic manipulation tasks. Traditional gripper designs often struggle with handling objects of various shapes, sizes, and orientations. Additionally, these grippers lack the ability to adjust their finger configurations dynamically based on the objects they encounter. This limitation hampers the overall flexibility and versatility of robotic systems in real-world applications.

Objectives:

a. To develop a three-finger adaptive gripper capable of adjusting its finger configuration based on the object's shape, size, and orientation.
b. To incorporate computer vision techniques for object recognition and pose estimation to enable the gripper to perceive and understand the objects in its environment.
c. To utilize SolidWorks for gripper design, simulation, and optimization, ensuring mechanical stability, robustness, and efficiency.
d. To apply the principles of kinematics of robotics to plan precise finger motions and optimize grasping strategies.

Methodology:

a. Research and analyse existing adaptive gripper designs and related literature to gain insights into current advancements and challenges in the field.
b. Develop a computer vision module that utilizes image processing techniques, such as object recognition and pose estimation, to provide the gripper with information about the objects in its environment.
c. Utilize SolidWorks software to design the three-finger adaptive gripper, considering factors such as material selection, actuation mechanisms, and mechanical stability.
d. Simulate and validate the gripper design in SolidWorks to ensure its functionality and performance in various grasping scenarios.
e. Apply the principles of kinematics of robotics to develop a grasp planner algorithm that optimizes the finger motions based on the object's characteristics and the desired grasp strategy.
f. Implement the proposed system on a physical robotic manipulator and conduct experiments to evaluate its performance in grasping different objects.

Expected Outcomes:

a. A functional three-finger adaptive gripper that can adjust its finger configuration according to the object's characteristics.
b. A computer vision module integrated into the gripper system for object recognition and pose estimation.
c. A gripper design optimized for mechanical stability, efficiency, and adaptability.
d. A grasp planner algorithm that effectively plans finger motions for achieving stable and reliable grasps.
e. Experimental results demonstrating the improved grasping capabilities and adaptability of the proposed system compared to traditional grippers.

Significance and Impact:

The successful implementation of the proposed research will contribute to the advancement of robotic manipulation capabilities. The three-finger adaptive gripper with a computer vision-assisted grasp planner can enhance the efficiency, versatility, and adaptability of robotic systems in various domains, including manufacturing, logistics, healthcare, and household robotics. The developed system can enable robots to handle complex objects with different shapes, sizes, and orientations, opening doors for increased automation and improved human-robot collaboration.

Conclusion:

The proposed research aims to address the limitations of traditional gripper designs by developing a three-finger adaptive gripper with a computer vision-assisted grasp planner. By integrating computer vision, SolidWorks, and kinematics of robotics, this system will enhance the grasping capabilities of robotic manipulators, leading to improved efficiency and adaptability. The successful completion of this research will contribute to the advancement of robotic manipulation and foster innovation in various industries.