NAZARBAYEV UNIVERSITY MULTIGRASP HAND WITH BIDIRECTIONAL TENDON ACTUATION

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Introduction. Robotic hands are being used in various areas such as industrial automation, medical robotics, and defense. In this work, we are presenting the Nazarbayev University Multigrasp Robot Hand with an integrated RGB-Depth camera for intelligent object manipulation. The novelty ofthe project is seen in the creation of an end effector system which obtains higher level autonomy from the base manipulator, being able to recognize target objects, generate approach trajectories and apply corresponding grasping patterns to capture the object.

Materials and Methods. The NU Hand was designed in Solidworks and was implemented using 3D printing technology. Digits are actuated using Futaba BLS153 and Dynamixel MX28 motors. Tendons are implemented using stainless steel lines with silicon coating. An RGB-Depth camera (DepthSense 325) is used as the primary sensor enabling recognition and classification of different objects.

Results and Discussion. Currently the second version of the hand is being developed. It consists of ten joints, which are actuated by ten tendons attached to four servo motors (see Fig. 1). The hand is intrinsically actuated (motors are contained within the hand palm). In the new iteration of the hand, bidirectional tendons are used to open and close the fingers. For this purpose special double level pulleys were designed. Initial experiments showed that the force and speed capabilities of the fingers are substantially (between 30 and 50 percent) increased thanks to the bidirectional tendon actuation compared to previous version of NU Hand. Apart from mechanical design of the multigrasp hand, we are developing algorithms for depth image based object classification and pose estimation. In order to generate the grasp dataset we have developed the data glove which interfaces the robot hand and provides the ability to mimic the motion of a human operator hand with data record capability.

Figure 1. NU Multigrasp Robot Hand.

Conclusions. Future work includes integration of the robot hand with the sensory module and industrial manipulator for development of intelligent manipulation algorithms.

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