

【Grant-in-Aid for Young Scientists(S)】

Integrated Science and Innovative Science (Comprehensive fields)



Title of Project : Research of the Next Generation of High-speed Advanced Robot Hand System

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Research Area : Comprehensive fields, Informatics, Intelligent robotics

Keyword : Sensory behavior system, Robot hand

【Purpose and Background of the Research】

Recently, the demands for the manufacturing of a wide variety of products in small quantities are increasing, and the needs of multifingered robot hands which can be used for multipurpose complicated tasks are also increasing. However, the capabilities of most robot hands are inferior to human hands.

In general, the principle of motion of a robot hand is different from that of a human hand. For this reason, it is difficult to improve the performance of a human mimic robot hand. In order to improve the performance, it is effective to design a robot hand based on robot hand specific characteristics. However, it is not still known how to design a robot hand which has a structure different from a human hand generally.

We have developed a high-speed hand by concentrating on the speed-up of both the motion and sensing. Also, by decomposing its dynamic handling abilities into multiple functional modules (dynamic skills), how to achieve a complicated manipulation and how to design an appropriate hand has been shown about some examples.

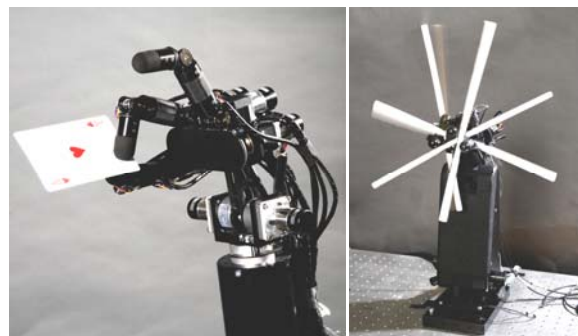
The aim of this project is to develop the next generation of an advanced robot hand by extending above results.

【Research Methods】

In this project, without imitating a human hand and based on constructive approaches, we aim to develop design methods of a robot hand by finding task-specific characteristics.

1. By analyzing multiple types of dynamic manipulation tasks of human (rope handling, paper handling, and precise assembling, and so on), we will extract basic dynamic manipulation skills.
2. By limiting the target objects, we will develop several types of semi general purpose advanced hands which can achieve high-performance within the limited range.
3. We will develop visual sensing system which is appropriate to dexterous manipulation. We will develop a robust 3D recognition method by compensating for occlusion of robot fingers.
4. By analyzing motions of manipulation, we will

establish an optimization method of the actuator parameters.



【Expected Research Achievements and Scientific Significance】

- By analyzing dynamic skills of human grasping and manipulation and extracting the essential components of manipulation, we will develop a new design method of robot hand different from a human hand.
- We will develop both sensor and actuator, and these can be applied to the other field.
- We have developed the robot hand system in which the speed of the motion is fastest in the world. By extending this result, we will achieve the highest-performance of robot hands in the world.

【Publications Relevant to the Project】

- Taku Seno, Akio Namiki, Masatoshi Ishikawa, Hybrid Trajectory Generation of an Articulated Manipulator for High-speed Batting, Journal of the Robotics Society of Japan, vol.24, No.4, pp.515-522, 2006
- Noriatsu Furukawa, Akio Namiki, Taku Seno and Masatoshi Ishikawa, Dynamic Regrasping Using a High-speed Multifingered Hand and a High-speed Vision System, IEEE Int. Conf. Robotics and Automation, pp.181-187, 2006

【Term of Project】

FY2009-2013

【Budget Allocation】

77,400 Thousand Yen

【Homepage Address and Other Contact Information】

<http://mec2.tm.chiba-u.jp/~namiki/>