

# The Scheme of Tableware Cleaning Machine Pick-Up Plate Manipulator

Mingzhe Li<sup>1,a</sup>, Bo Tang<sup>2,\*</sup>, Guangze Zhou<sup>1,b</sup>, Meixuan Chen<sup>1,c</sup>, Chang Li<sup>1,d</sup>,  
Zhicheng Yu<sup>1,e</sup>, Zhuo Zeng<sup>1,f</sup>, Yingnan Chen<sup>1,g</sup>

<sup>1</sup>School of Mechatronics Engineering, Shenyang Aerospace University, Shenyang 110136, China

<sup>2</sup>Engineering Training Center, Shenyang Aerospace University, Shenyang 110136, China

\*Corresponding author e-mail: 1092786432@qq.com, <sup>a</sup>846292225@qq.com,

<sup>b</sup>1361149405@qq.com, <sup>c</sup>1046596172@qq.com, <sup>d</sup>2054529470@qq.com,

<sup>e</sup>15241863740@163.com, <sup>f</sup>765510164@qq.com, <sup>g</sup>840399480@qq.com

**Abstract.** This manipulator as an important part of the dish washer, mainly by hand, motion mechanism and control system structure, implementation will eat dish from containing fetching plates of box to take dish of mechanism movement. The hand is used to grab the plate, and the motion mechanism enables the hand to complete all kinds of rotation, movement or complex movements to achieve the specified action and change the position of the plate being grabbed. The lifting, stretching, rotating and other independent motion modes of the motion mechanism become the freedom degree of the manipulator. In order to grab all the plates in the box, the manipulator needs 5degrees of freedom, the more it does, the more flexible the manipulator will be, and the more versatile it is. The control system is to complete a specific action by controlling the moter with each degree of freedom of the manipulator. At the same time, it receives the information from the sensor to form a stable closed-loop control.

## 1. Introduction

The cafeteria tableware cleaning mainly rely on artificial to complete, so cannot ensure the cleaning of tableware health, added the human resources cost of canteen, in view of this situation we team which improved the traditional dishwasher, plates, spoons and chopsticks will be the cleaning and disinfection of tableware, collect and access, and other functions, so as to produce tableware cleaner plate. As an important part of dish washing machine, the manipulator is researched and innovated here.

Manipulator used in the automatic production process with grab moving the workpiece is one kind of automatic device, it is in the process of mechanization, automation production, developed a new type of device, the manipulator can replace human dangerous, repetition boring work, reduce human labor intensity, improve labor productivity. Manipulator has been more and more widely used, it can be used for parts assembled in the machinery industry, machining workpiece handling, loading and unloading, especially on the automatic CNC machine, combination machine tool use is more common. It is suitable for medium and small batch production, which can save huge workpiece conveying device, compact structure and strong adaptability. At present our country's industrial robot technology



and its engineering application level and foreign than there is a certain gap, scale and low level of industrialization, the research and development of the manipulator directly affects our country to raise the level of automation of production from the consideration on the economic and technology is very necessary. Therefore, the research and design of manipulator are very meaningful.

## **2. Analyzation**

### **1) Tableware cleaning**

The main body includes tableware cleaning, disinfection, waste disposal, water circulation and collection system. The tableware cleaning system includes dishes, spoons and chopsticks cleaning. The disinfection system is divided into high temperature and ultraviolet disinfection. Waste disposal systems include the collection and disposal of food residues. The water circulation system is mainly the secondary utilization of waste water. The collection system is divided into chopsticks, spoons and plates.

## **3. The innovation points**

- a) Combine the dishes: chopsticks, spoons and dishes.
- b) Integrate the cleaning, disinfection and collection devices into a single machine.
- c) Design the cleaning track into a multi-dimensional space structure when cleaning the dinner plate, avoiding the single direction design of the track of the traditional cleaning machine, so as to save space.
- d) To save water, the water circulation system is designed to improve the utilization rate of water.

### **2) Take-up Manipulator**

The main body includes the manipulator's horizontal forward and backward moving system, the vertical lifting system, the horizontal stretching system of the manipulator and the clamping system of the mechanical claw. Through the above system, the robot hand can move in all directions. Through the special design of the front part of the robot claw, the robot claw can easily tighten the plate.

## **4. The innovation points**

- a) Through to the manipulator increase rotation system settings can be 360°omni-directional mobile, so that the manipulator movement more flexible.
- b) By attaching rubber material to the inner wall of the mechanical claw, the friction between the mechanical claw and plate is increased, so that the mechanical claw can firmly grasp the plate and prevent the plate from falling off in the middle of the meal.
- c) The precise design of the position of the manipulator can reduce the motion stroke of the manipulator and shorten the size of the manipulator.

## **5. Conclusion**

Manipulator is the most widely in the field of robot technology in the practical application of automated machinery, in the industrial manufacturing, medical treatment, entertainment services, military, semiconductor manufacturing, as well as in areas such as space exploration can see the figure of it. The manipulator can effectively replace the manual work and stabilize the quality of the product. Our products have other advantages on this basis.

### **1) Labor saving:**

The tray taken out by the robot hand is placed on the receiving table, and only one person needs to take care of the whole tableware cleaning machine, which can save labor cost, improve work efficiency and provide a guarantee for the dining room tableware circulation.

### **2) High security:**

The manipulator is installed on the receiving platform, so that the hand and the platform are connected by bolts, so as to prevent accidental shedding of the manipulator and injury to the personnel. In addition, our manipulator has reduced the possibility of accidental contact due to its exquisite size and small working range.

### 3) Easy maintenance/replacement:

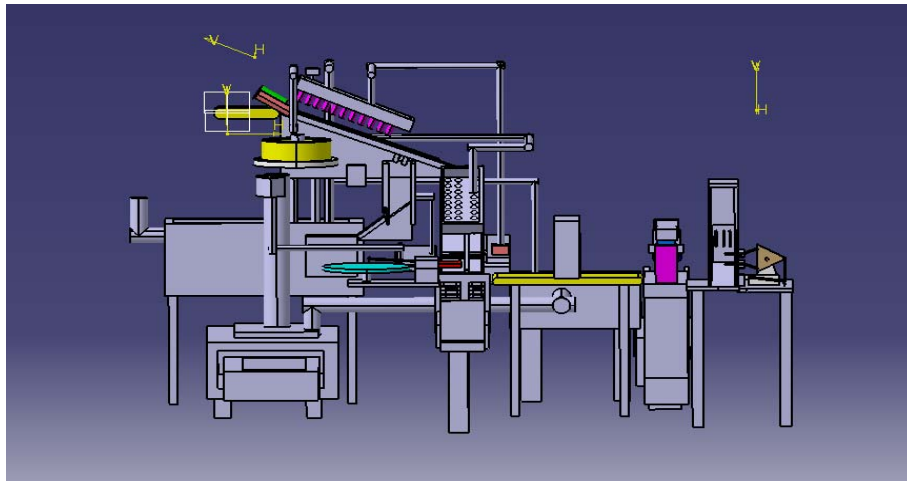
The manipulator is easily removed from the receiving platform because it is bolted. In case of failure, it is easy to take off the repair and replace the spare manipulator.

### 4) Stronger grasping:

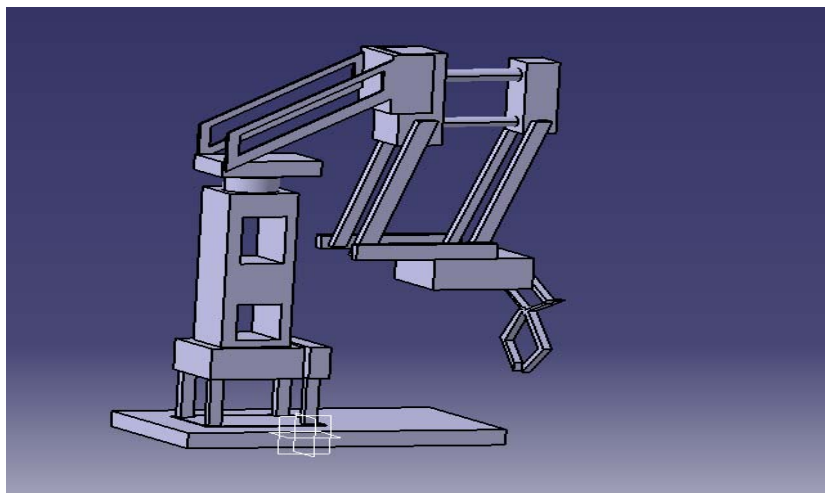
With a layer of rubber attached to the inner wall of the mechanical claw part of the manipulator, more food dishes can be grabbed with less power, saving energy and costs.

## 6. Picture Presentation

When goods and machinery to clamping claw is not in a straight line, through the first steering gear drives the mechanical paw and mechanical claw rotation to achieve goods picking up (before the mechanical claw rotation angle for  $0^\circ$  to  $180^\circ$ ). At the same time, when the center axis of the object is not in the same line as the axis of the mechanical claw, we can rotate the second steering machine to achieve  $360^\circ$  clamping.



**Figure 1.**Dishwasher Chart



**Figure 2.**Manipulator Chart

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