Test Project (Offline)

BRICS-FS-25_Cooperative robot

2022 BRICS Skills Competition

catalogue

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1. Form of participation

Team entry (2 people).

2. Content of the competition

The competition consists of three modules that are completed in order. Provide the participants with task instructions, circuit diagrams, equipment layout, equipment operation instructions, and data sources or other technical fundamentals required to ensure the independence and fairness of each task module. The competition includes the following task modules based on the application and development of the collaborative robot training platform:

1) Mechanical installation and cooperative robot pattern drawing
2) The cooperative robot assembles small motors after handling and palletizing
3) Cooperative robot with visual Tetris

The competition task and scoring criteria can only be changed if the competition site cannot be completed and is approved by the lead expert.

Competitors may be disqualified if they do not comply with occupational health and safety environment requirements, or put themselves and other players at risk.

Participants will score the results after completing the module

3. Project module and time requirements

3.1 Project module and time requirements

The collaborative robot event has a total of three modules, requiring players to complete within 12 hours. See Table 1 for the specific project module name and time requirements.

Table 1 List of project modules and time requirements

order number	Module name	Completion time of the competition content
1	Module A: Installation and debugging of the assembly and positioning platform and the cooperative robot pattern drawing	120 min
2	Module B: cooperative robot assembly of small motor after handling and palletizing	240 min
3	Module C: Collaborative robot with visual Lower Tetris	360 min

3.2 Introduction of the task scenario

Scenario 1: The company has introduced a new set of equipment, requiring technicians to assemble and color sorting the small motors. While completing the motor assembly and sorting, they need to learn the track practice of collaborative robots.

Scenario 2: in recent years, with the development of the robot, between collaborative robot man-machine collaboration function makes collaborative robot in service is more widely used, such as: coffee flower robot, tea robot, milk tea robot, etc., on the basis of the company in the game industry new development collaboration robot tetris scene, need company technicians to collaborative robot with visual detection debugging to complete the artificial intelligence collaboration robot under tetris game.

3.3 Introduction of the comprehensive training platform of cooperative Robot technology and application

1. Composition

Collaborative robot, component shelf, sorting conveyor belt, assembly and positioning platform, finished product material plate, disordered component material plate, excessive material plate, cooperative robot tool platform, 3D vision, 2D vision, upper computer system, programmable controller system, artificial intelligence algorithm platform, digital twin platform, etc.

3.4 Task Content

Module A mechanical adjustment and cooperative robot pattern drawing

Participants shall complete the installation and debugging of the assembly and positioning platform of the collaborative robot training platform according to the task requirements. The tasks shall include the following contents:

1) Assembly of mechanical parts
2) Trace pipe connection
3) Installation of the magnetic switch
4) Mechanical debugging
5) Pneumatic commissioning
6) Electrical debugging

Task Description: This module is uniformly provided by the organizing committee for the actual operation view on the cooperative robot training platform.

Task A1: Assembly and commissioning of the assembly and positioning platform

Assembly according to the mechanical assembly drawing, and install according to the installation location drawing.Please ensure that screws are fastened reliably, trachea is inserted correctly and electrical components are installed correctly during the task.

1. Task requirements

1) Assembly is performed according to the assembly diagram

2) Installation in the correct position of the platform (± 3mm)

3) Pipe intubation and debugging according to the gas path diagram

4) Install and debug the position of electrical components according to the schematic diagram

2. Pneumatic schematic diagram

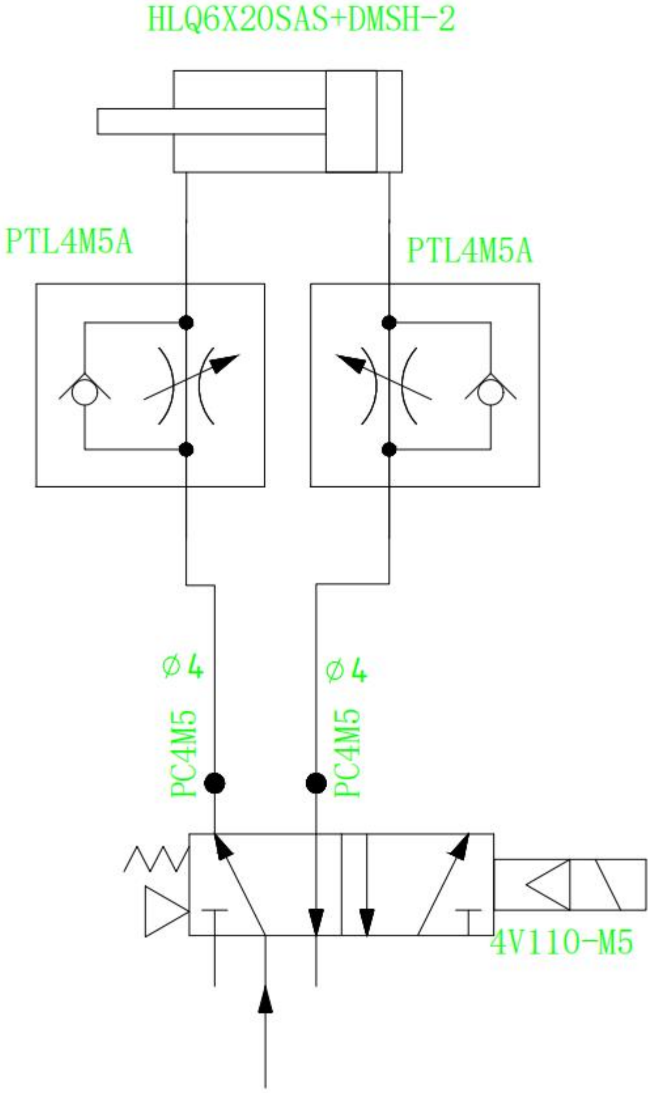

HLQ6X20SAS+DMSH-2
PTL4M5A
PTL4M5A
Ø4
Ø4
PC4M5
PC4M5
4V110-M5

Figure 3 Aeratic diagram of assembly and positioning cylinder

3. Electrical schematic diagram (part)

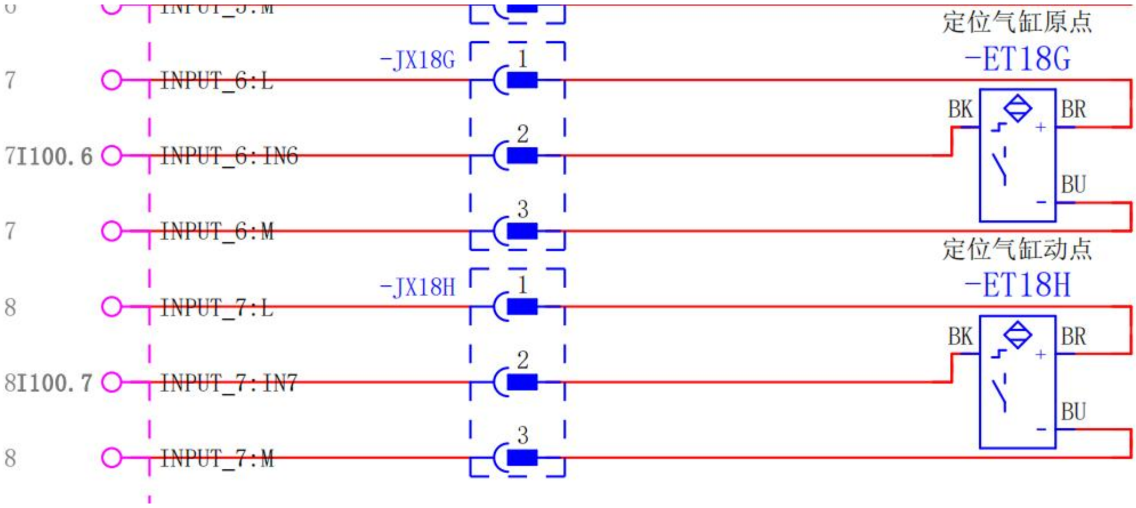
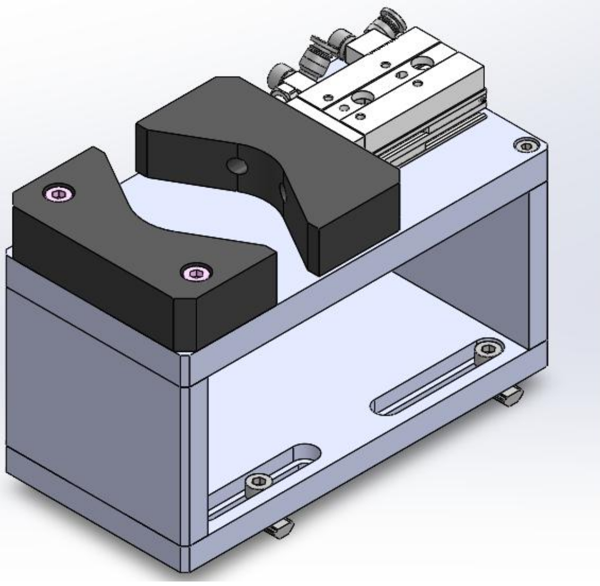
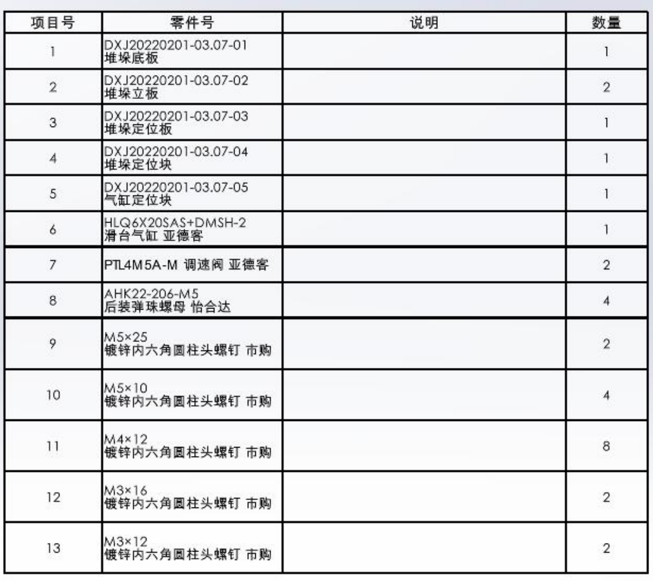

6
INPUT_5:M
定位气缸原点
-ET18G
7
INPUT_6:L
-JX18G
1
BK
BR
+
7I100.6
INPUT_6:IN6
2
BU
-
7
INPUT_6:M
3
定位气缸动点
-ET18H
8
INPUT_7:L
-JX18H
1
BK
BR
+
8I100.7
INPUT_7:IN7
2
BU
-
8
INPUT_7:M
3

Figure 4. Schematic diagram of the magnetic switch part

4． Parts list





项目号	零件号	说明	数量
1	DXJ20220201-03.07-01 堆垛底板		1
2	DXJ20220201-03.07-02 堆垛立板		2
3	DXJ20220201-03.07-03 堆垛定位板		1
4	DXJ20220201-03.07-04 堆垛定位块		1
5	DXJ20220201-03.07-05 气缸定位块		1
6	HLQ6X20SAS+DMSH-2 滑台气缸 亚德客		1
7	PTL4M5A-M 调速阀 亚德客		2
8	AHK22-206-M5 后装弹珠螺母 怡合达		4
9	M5×25 镀锌内六角圆柱头螺钉 市购		2
10	M5×10 镀锌内六角圆柱头螺钉 市购		4
11	M4×12 镀锌内六角圆柱头螺钉 市购		8
12	M3×16 镀锌内六角圆柱头螺钉 市购		2
13	M3×12 镀锌内六角圆柱头螺钉 市购		2

Figure 5. Parts Table

5. assembly drawing

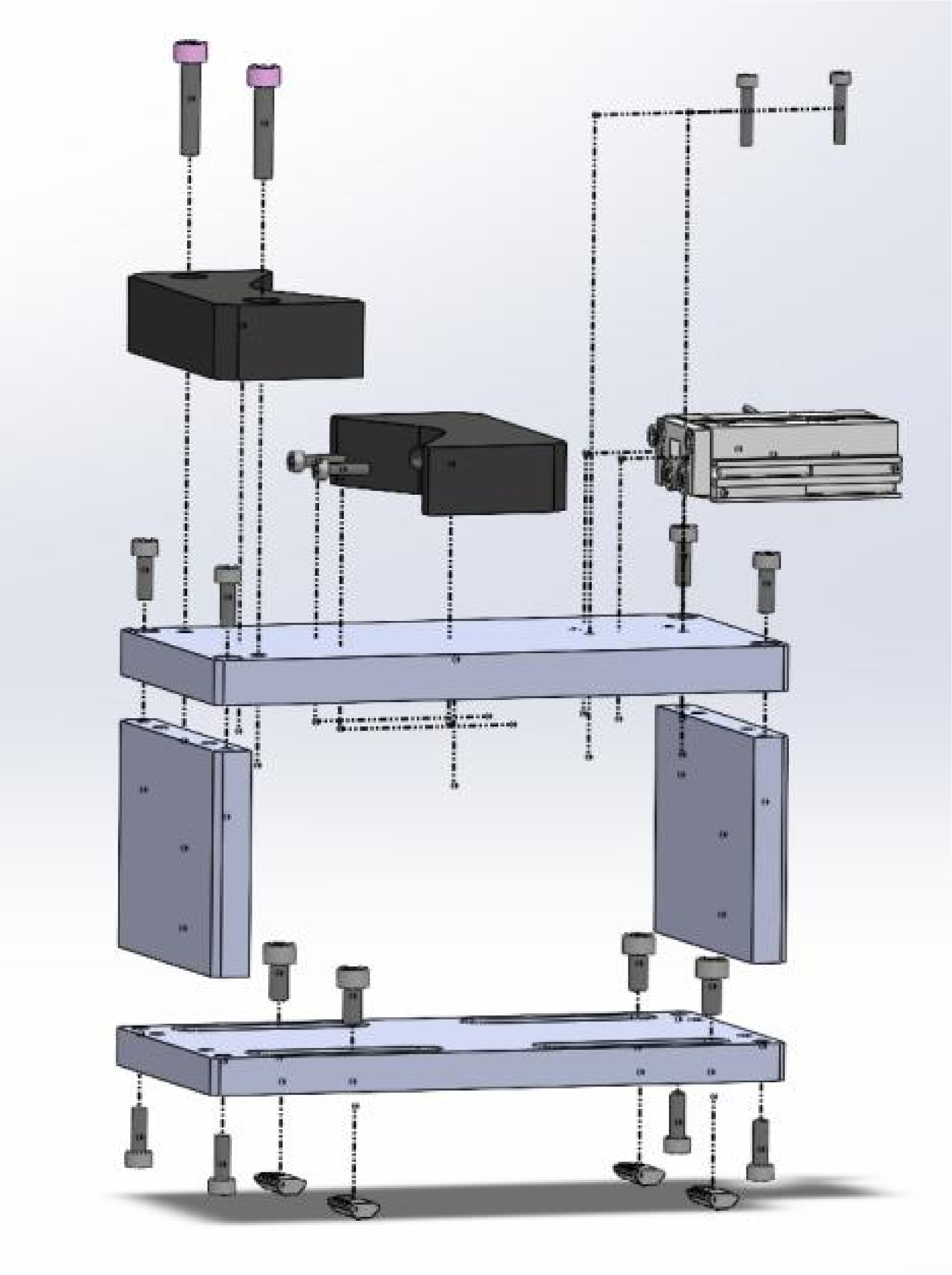


Figure 6. Assembly drawing

6. Installation location requirements

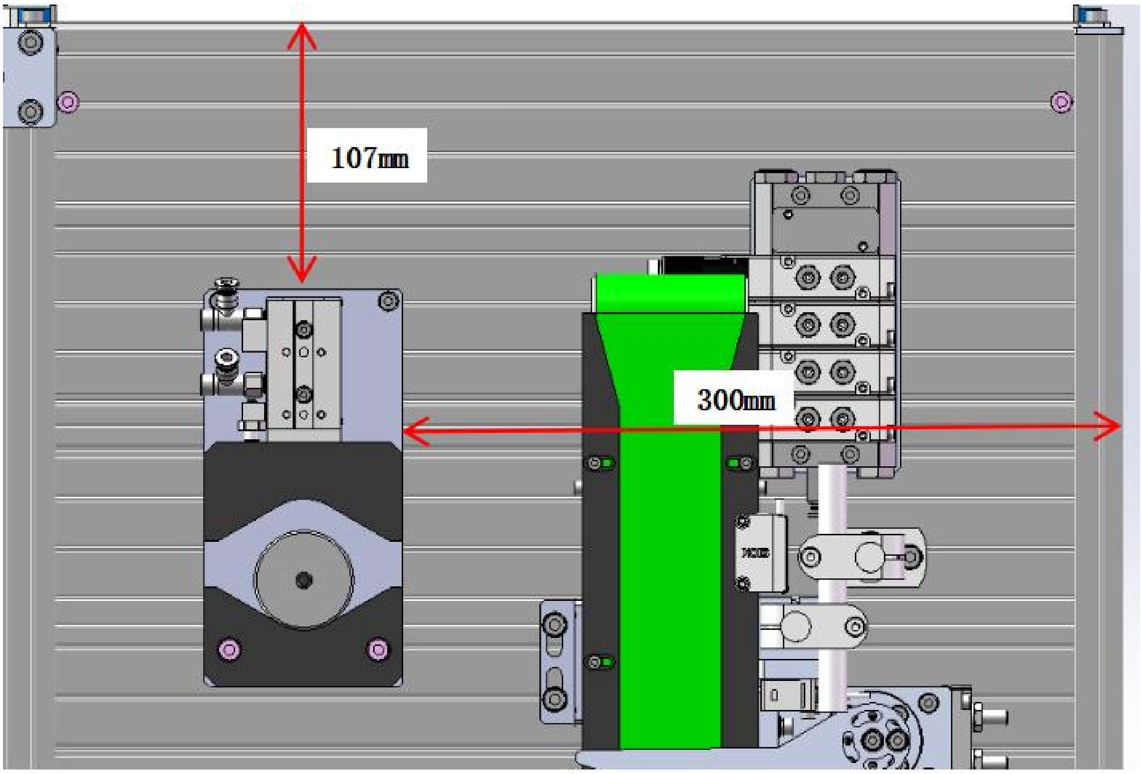


Figure 7. Installation location diagram

A2 Draw patterns and text according to the track table pattern, and take and put the brush tools

The contestants shall complete the robot debugging and teaching according to the task requirements, including the following contents:

1) Edit the automatic program to install the brushes;

2) The editing automatic program draws the corresponding pattern on the track table;

3) Edit the automatic program to uninstall brushes;

Task Description: This module is uniformly provided by the organizing committee for the actual operation view on the cooperative robot training platform.

Task A2: automatically install the brush, draw the track pattern as shown in Figure 8, and automatically uninstall the brush

1. Automatic program process of collaborative robot

Please program with the presentation device

Specific requirements:

1) The cooperative robot is started and operated at a reasonable initial position;

2) Automatically install the brush, draw the track pattern as shown in Figure 8 (purple), and automatically uninstall the brush, and there can be an appropriate delay in the middle, and the whole process needs to be completed continuously in one program;

3) No mechanical collision is allowed in the middle;

2. Track pattern

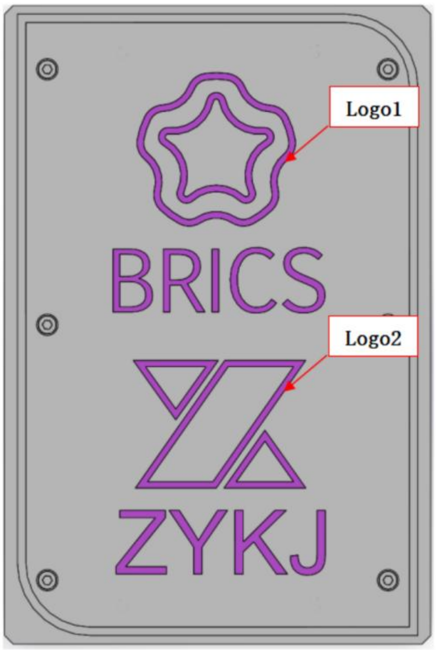


Figure 8. Track pattern

3．tool table

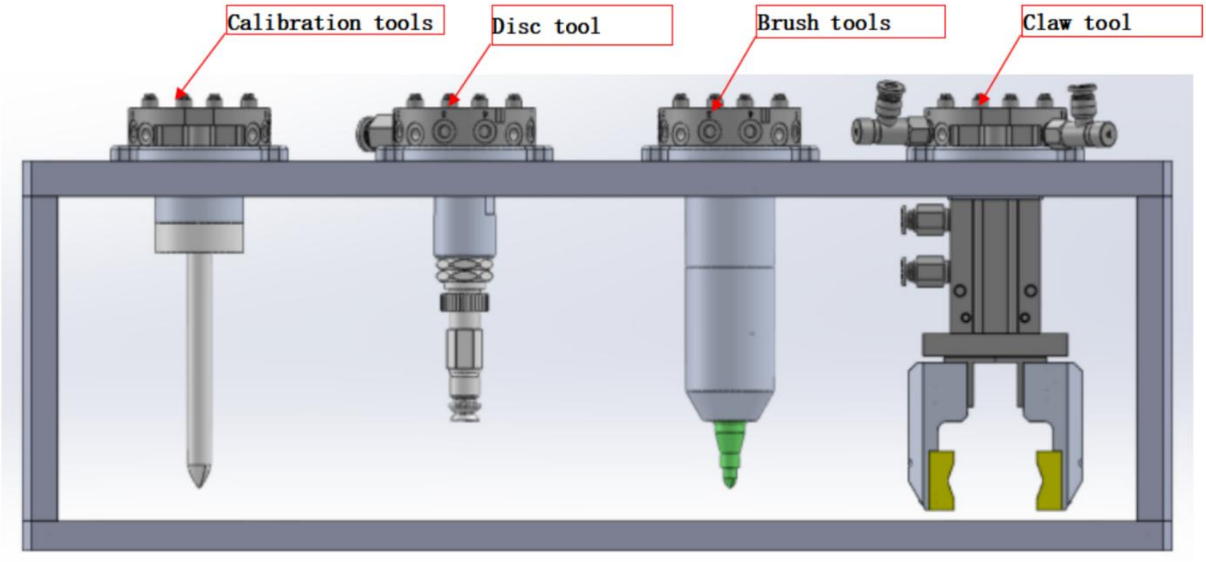

Calibration tools
Disc tool
Brush tools
Claw tool

Figure 9. Toolbed

4. Collaborative robot I / O definition

Table 1 Definition of Collaborative robot I / O

stitch	The PLC I / O description	Remote I / O description	Robot I / O description
SI00			Robot emergency stop circuit 1
SI10			Robot emergency stop circuit 2
DI00			vacuum
DO00			vacuum chuck
DO01			Claw cylinder
DO02			quick-change connector

Module B cooperative robot assembles the small motor after handling and palletizing

The contestants shall complete the robot debugging and teaching according to the task requirements, including the following contents:

1) Automatic installation and unloading of the claw clip tool;
2) PLC programming;
3) Touch screen configuration;
4) The motor bottom shell is sorted according to the color;
5) Motor assembly;
6) Finished motor placement;

Task Description: This module is uniformly provided by the organizing committee for the actual operation view on the cooperative robot training platform.

Task B 1: Motor shell sorting according to color, motor assembly, pick and release claw tool

1. Automatic program process of collaborative robot

Please program with the presentation device

Specific requirements:

1）The cooperative robot is started and operated at a reasonable initial position;

2）Automatic installation of claw tool, motor shell according to the color sorting, rotor assembly, motor assembly of the upper cover assembly, finished product placement, there can be an appropriate delay in the middle, the whole process needs to be continuously executed in a program (a total of 6 motors);

3）Design according to the touch screen design requirements;

4）No mechanical collision is allowed in the middle;

2．Touch-screen design requirements

Table 2 Touch-screen Design Requirements

region 1	region 2	region 3	region 4
region 5	region 6	region 7	region 8
region 9	region 10	region 11	region 12
region 13	region 14	region 15	region 16

The 1616 grids represent 16 different regions, each requiring the figure below:

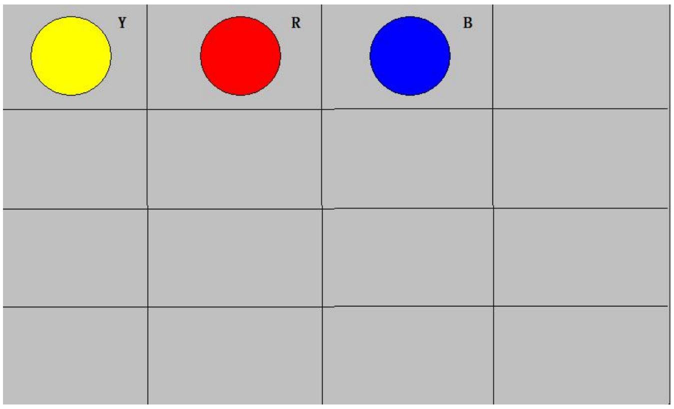


Figure 9. Touch-screen design

The indicator light is gray or white when not lit;

When the yellow indicator is detected yellow, the other indicators keep the initial state into the finger The yellow indicator light goes off after the fixed slide;

Similar with yellow when the artifact was detected as red or blue.

3. The I / O Definition

Table 3 Collaborative robot I / O definition

stitch	**The PLC I / O description**	**Remote I / O description**	**Robot I / O description**
I0.0	firing		
I0.1	reset		
I0.2	suspend		
I0.3	initialise		
I0.4	hand movement		
I0.5	voluntarily		
I0.6	jerk		
I100.0		Front block cylinder origin	

I100.1		Front block cylinder moving point	
I100.2		Channel 1 blocks the cylinder origin	
I100.3		Channel 1 blocks the cylinder moving point	
I100.4		Channel 2 blocks the cylinder origin	
I100.5		Channel 2 blocks the cylinder moving point	
I100.6		Locate the cylinder and cylinder origin	
I100.7		Locate the cylinder-air-cylinder moving point	
I101.0		Color detection 1	
I101.1		Color detection 2	
I101.2		Color detection 3	
I101.3		Channel product detection 1	
I101.4		Channel product detection 2	
I101.5		Channel product detection: 3	
I101.6		Delivery line product inspection	
Q0.0	Start the indicator light		
Q0.1	Reset the indicator light		
Q0.2	Stop the indicator light		
Q0.3	Initialize the indicator light		
Q0.4	Transmission line motor starts		
Q100.0		Front hold-out cylinder action	
Q100.1		Channel 1 blocks the cylinder action	
Q100.2		Channel 2 blocks the cylinder action	
Q100.3		Positioning cylinder action	
Q100.4		Three color light green	
Q100.5		Three color light yellow	
Q100.6		Three-color light red	

4. Local profile

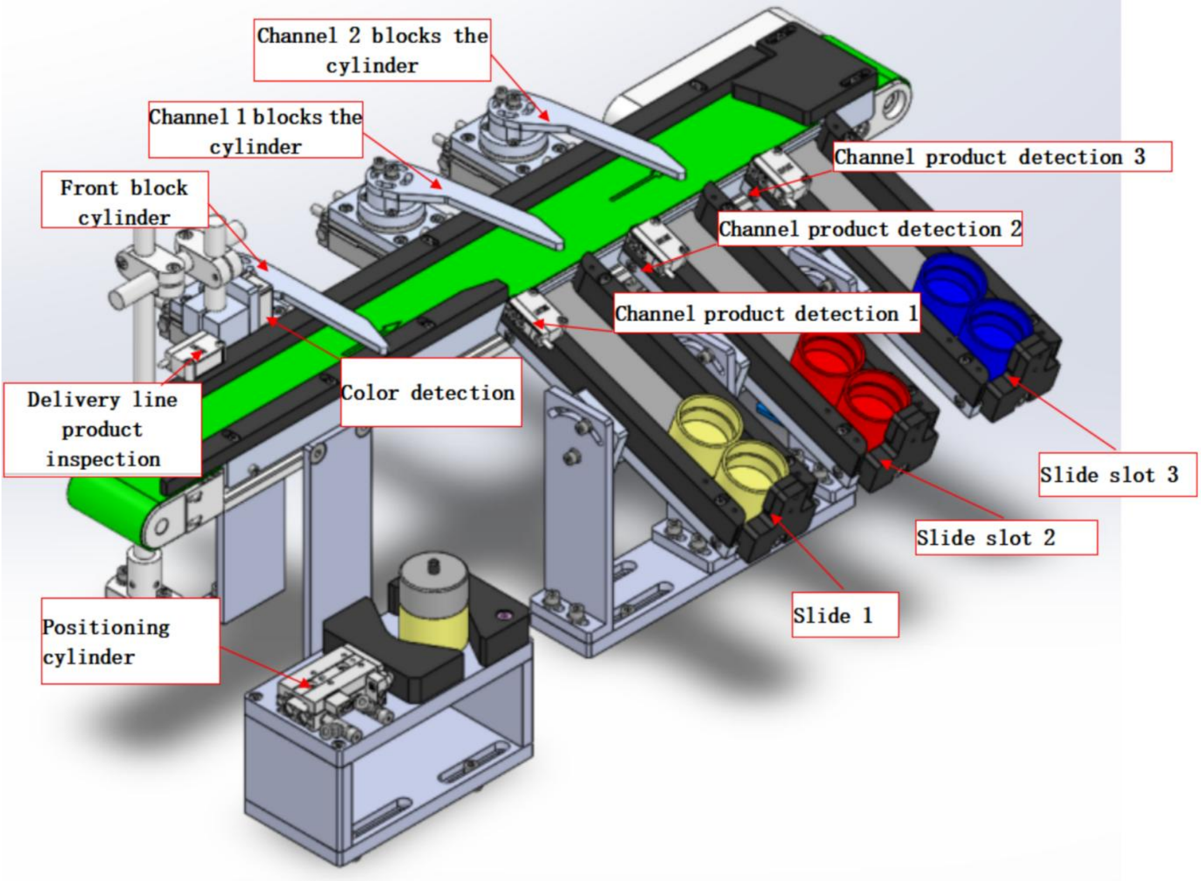

Channel 2 blocks the cylinder
Channel 1 blocks the cylinder
Front block cylinder
Channel product detection 3
Channel product detection 2
Channel product detection 1
Delivery line product inspection
Color detection
Slide slot 3
Slide slot 2
Slide 1
Positioning cylinder

Figure 10 Sorting and delivery line and assembly and positioning platform

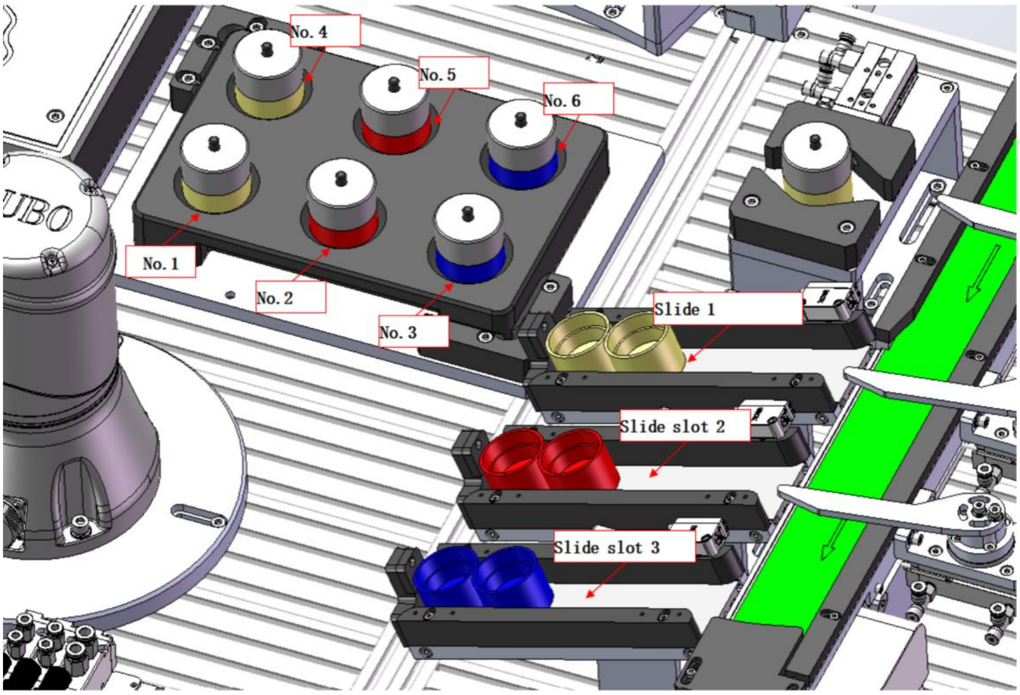

No. 4
No. 5
No. 6
No. 1
No. 2
No. 3
Slide 1
Slide slot 2
Slide slot 3

Figure 11 Finished material plate

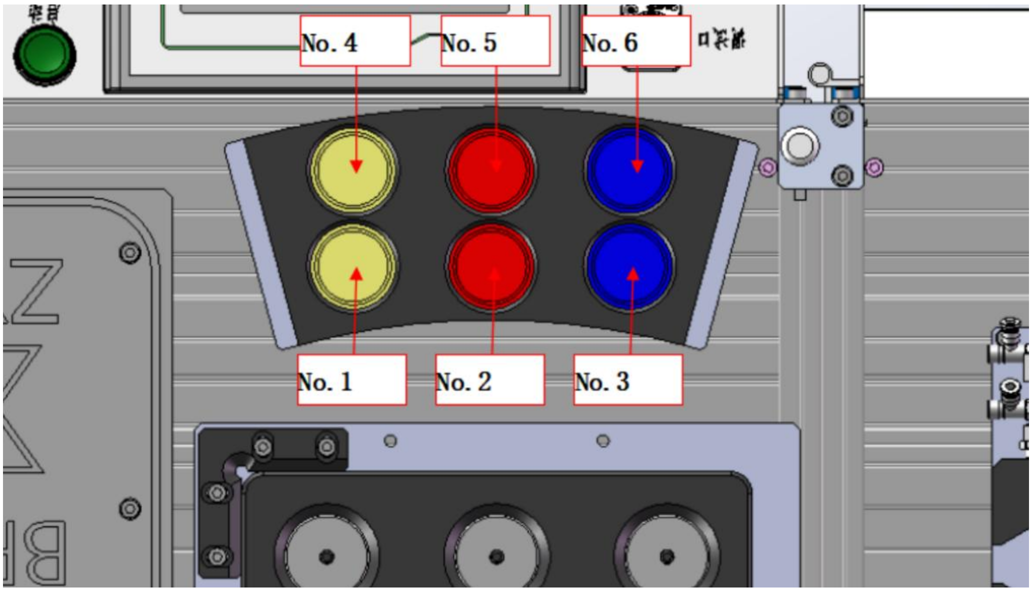

No. 4
No. 5
No. 6
No. 1
No. 2
No. 3

Figure 12. Lower layer of the component shelf

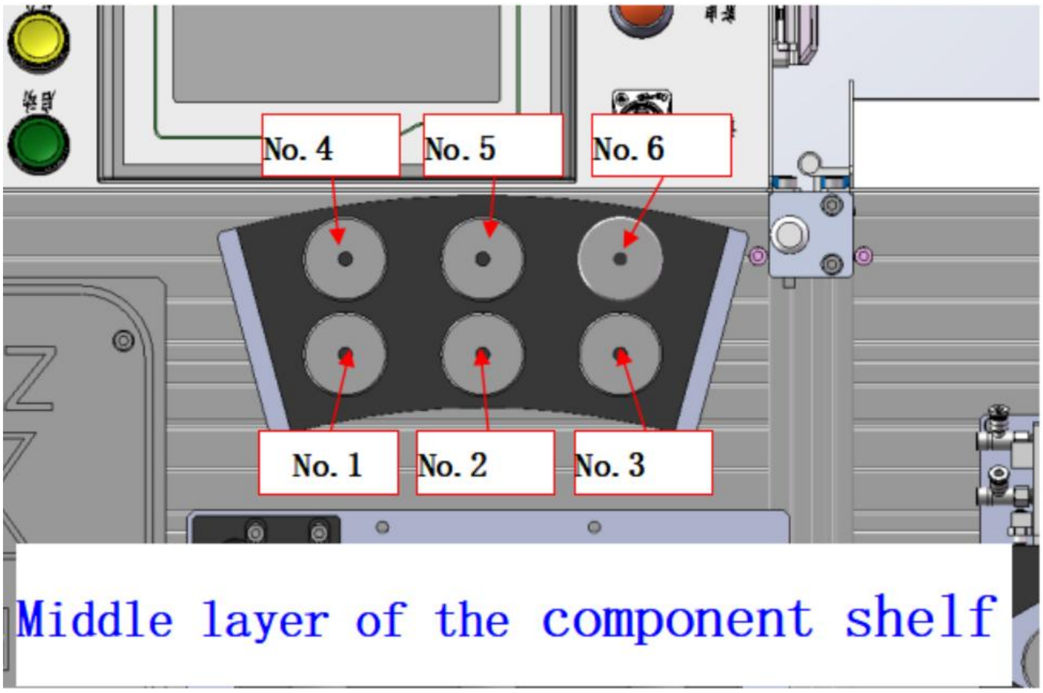

No. 4
No. 5
No. 6
No. 1
No. 2
No. 3
Middle layer of the component shelf

Figure 13. Middle layer of the component shelf

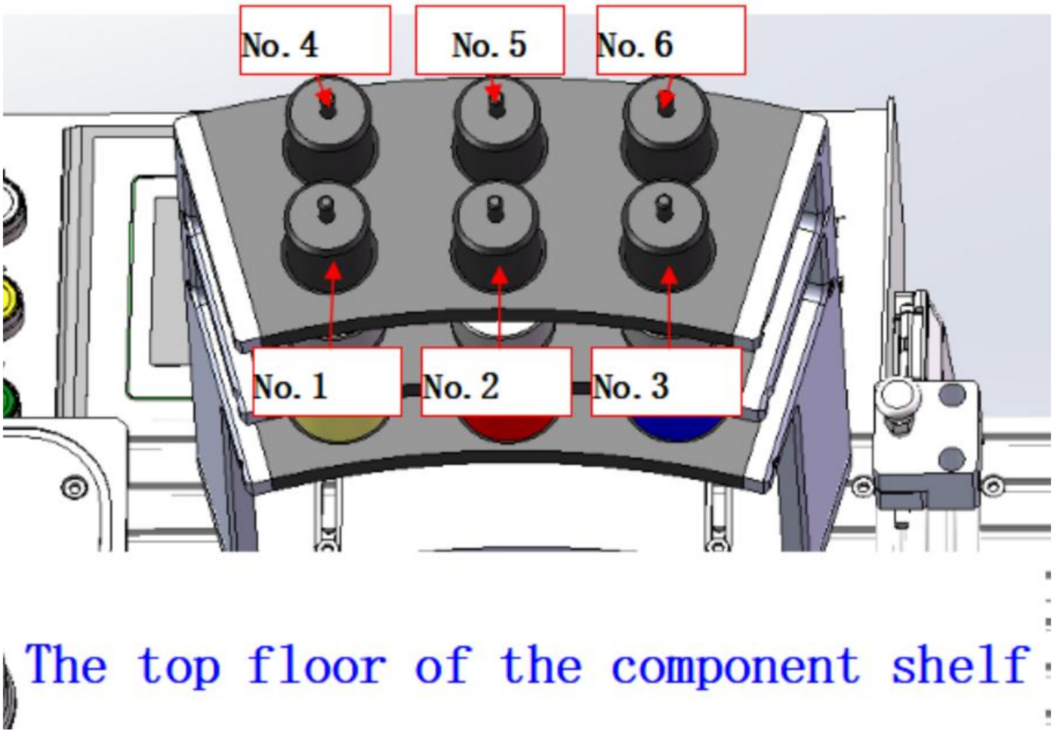

No. 4
No. 5
No. 6
No. 1
No. 2
No. 3
The top floor of the component shelf

Figure 14. Top layer of the component shelf

Module C collaboration robot with visual Lower Tetris

Participants shall complete the robot debugging, teaching and visual calibration according to the task requirements. The task includes the following contents:

1) Hand-eye calibration of the 3D camera;
2) Hand-eye calibration of 22D cameras;
3) 2D camera (below) production template position input;
4) 2D camera (top) production template position input;
5) Automatic pick-up and release of the suction cup tool;

Task Description: This module is uniformly provided by the organizing committee for the actual operation view on the cooperative robot training platform.

Task C 1: Collaborative robot with visual Tetris

1. Automatic program process of collaborative robot

Please use JSP, MVP, programming

Specific requirements:

1) Automatic installation of the suction cup tool;

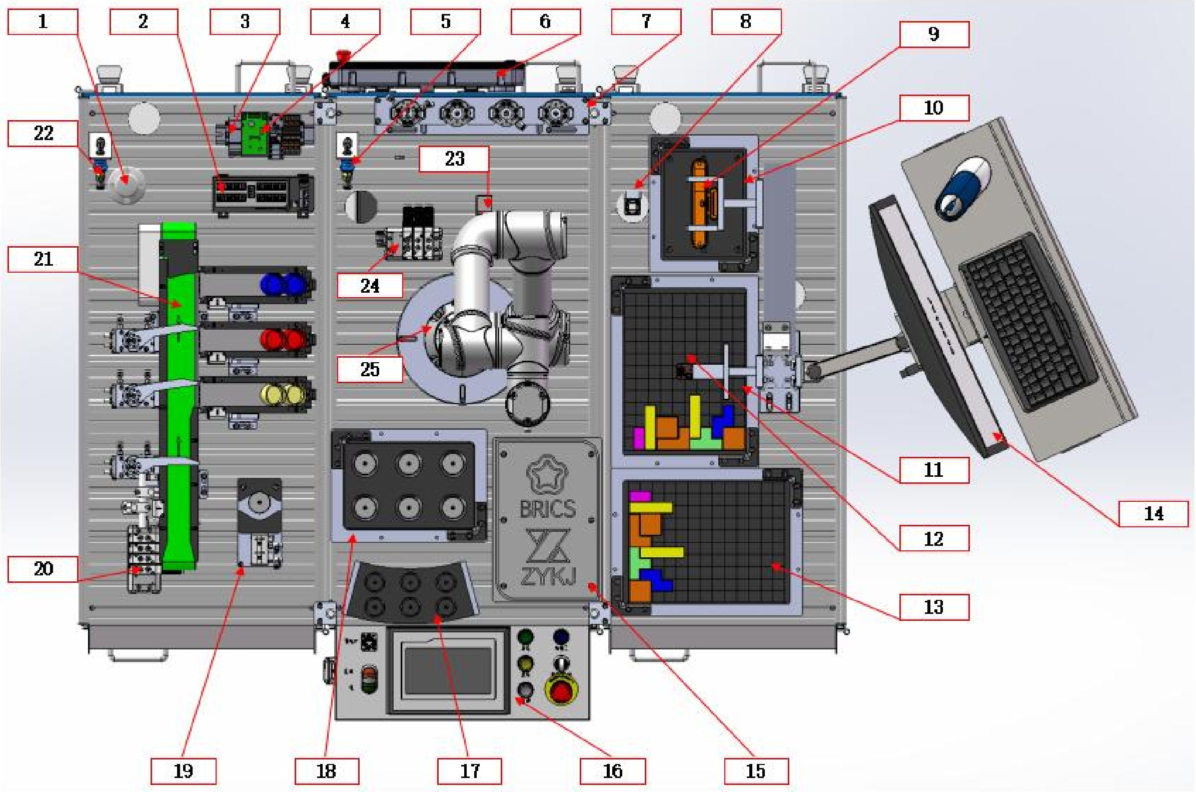
2) With 3D camera, 2D camera (bottom) and cooperative robot, the 14 (7 kinds of) disordered Tetris (Figure 19) are coded from 3D plate to 2D plate in the specified order (Figure 20);

3) With 2D camera (top) and cooperative robot, 14 (7 kinds) disordered (no superposition) Tetris are placed to the 2D plate according to the order specified by the generator (Figure 17) (Figure 18);

4）Automatic uninstall the sucker tool;

5) No mechanical collision is allowed in the middle;

2. Platform profile



1. Warning lights
2. Remote I/O
3. Color sensing amplifier
4. Belt motor drive card
5. Compressed air switch
6. Teaching apparatus
7. Switching table
8. 2D camera_down
9. 3D camera
10. 3D tray
11. 2D tray
12. 2D camera_up
13. Place the tray
14. Industrial PC
15. Track units1
16. Operation panel/Touch screen
17. shelves
18. The finished product
19. Assembly location
20. Solenoid valve
21. Conveyor line
22. Compressed air switch
23. Vacuum generator/Vacuum switch
24. Solenoid valve
25. Cooperative robot

Figure 15: Platform Introduction

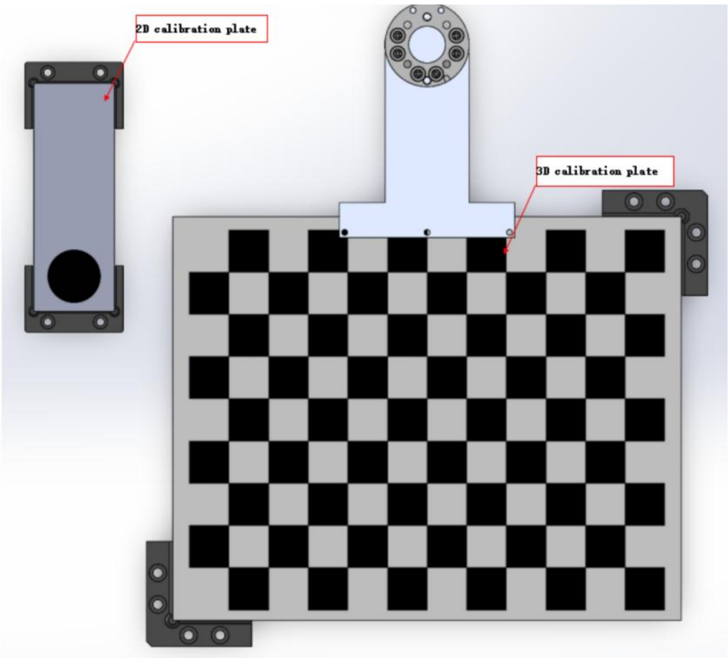
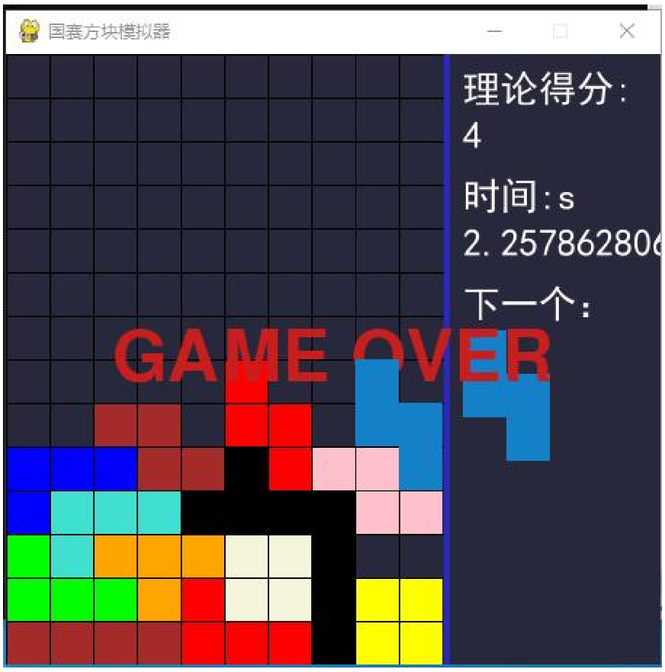

2D calibration plate
3D calibration plate

Figure 16. The calibration plate


国赛方块模拟器
GAME OVER

理论得分：
4

时间：s
2. 25786280

下一个：

Figure 17 The generator specifies the placement position

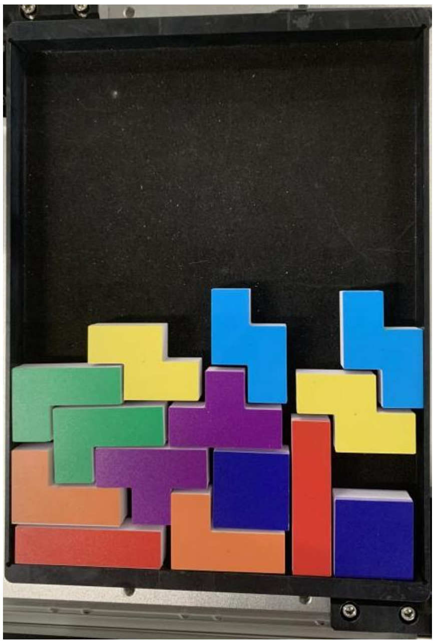


FIG. 18 codes to the stacking tray state according to the stacking position specified by the generator

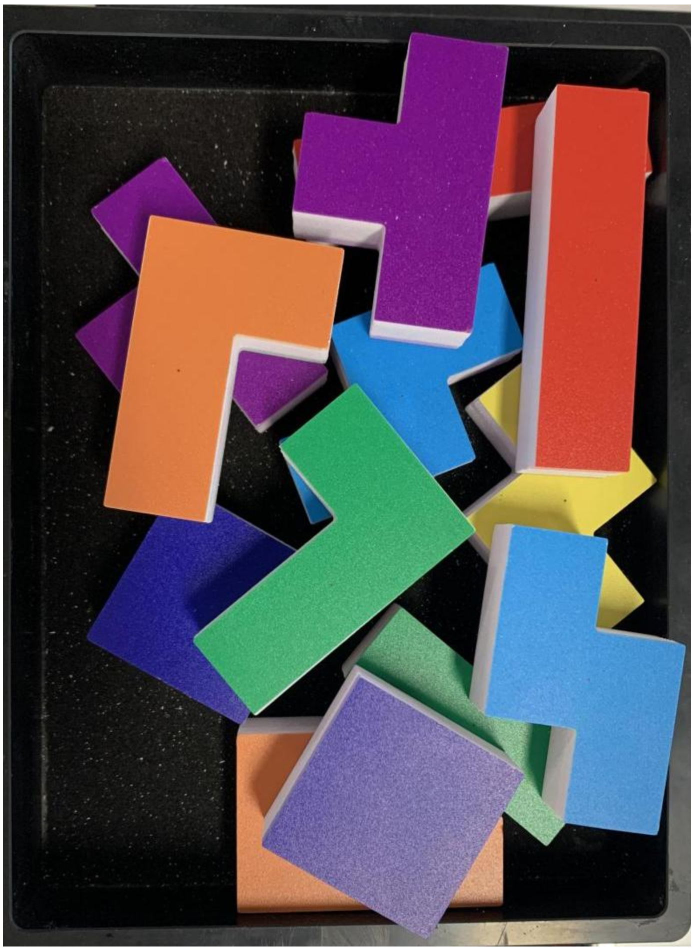


Figure 19 3D material plate

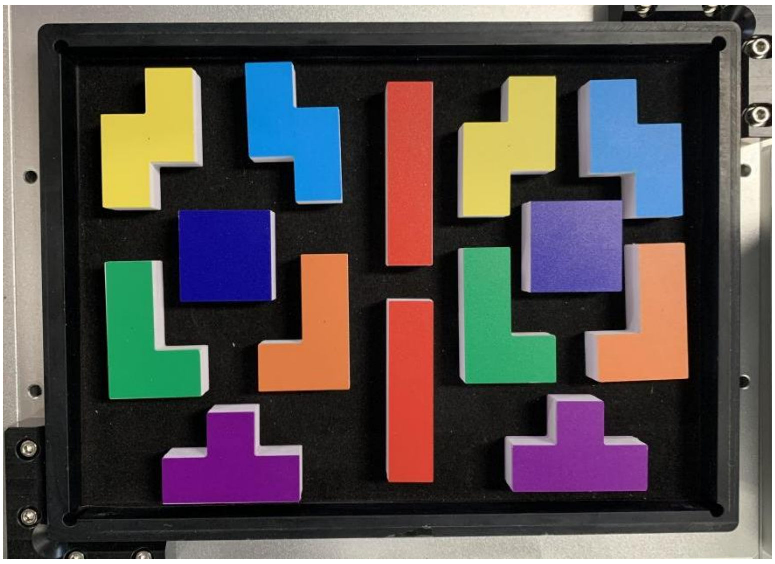


Figure 20 2D material plate

4. Scoring criteria

Table 10. Scoring criteria

module	detailed rules and regulations	value
A 1	1. The correct mechanism assembly meets the assembly specification (2 points); 2. The installation position of the mechanism is accurately within 3mm of ± (2 points); 3. Correct tracheal insertion (2 points); 4. Correct installation position of the magnetic switch (I / O signal is correct) (2 points); 5. Cable and trachea binding positioning is beautiful and reasonable (2 points);	10
A 2	1. Automatic installation of the brush was successful (2 points); 2. Draw the trajectory respectively: {Logo1, Logo2, B, R, I, C, S, Z, Y, K, J} (1 + 0.5 * 10=6 points); 3. Automatic uninstalling the brush successfully (2 points); 4. The subsequent action of the module is not score after the mechanical collision in operation (refers to the impact protection of the robot);	10
B	1. Automatic installation of claw clip successfully (1.5 points); 2. Successfully remove and release 6 motor bottom shells (0.5 * 12=6 points); 3. Successfully sorted 6 motor bottom shells by sliding into the corresponding chute (1 * 6=6 points); 4. During the process of sorting the 6 motor shells, the	45

	touch screen lights the corresponding color light, and the warning light lights the corresponding color light (yellow bottom-yellow light, red bottom-red light, blue bottom-green light) (0.5 * 12=6 points); 5. Successfully remove and put 6 motor bottom shells during the motor assembly process (0.5 * 12=6 points); 6. Successfully collect and assemble the assembly motor process with 6 motor rotors (0.5 * 12=6 points); 7. Successfully collect and assemble 6 motor upper caps (0.5 * 12=6 points); 8. After the assembly is completed, successfully put the 6 motors into the finished material plate (0.5 * 12=6 points); 9. Automatic unloading of the claw clip successfully (1.5 points); 10. The subsequent action of the module is not score after the mechanical collision in operation (refers to the robot impact protection);	
C	1. Automatic installation of the suction cup tool (1 point); 2. Place 14 (7 kinds of) of disordered Tetris (Figure 19) from 3D plates to 2D plates (Figure 20) in the specified order (0.5 * 28=14 points); 3. Place 14 (7 kinds of) disordered (no superposition) Tetris to the 2D material plate (Figure 18) in the order specified by the generator (Figure 17) (0.5 * 28=14 points); 4. Automatic uninstall the suction cup tool (1 point);	30
D	professional quality	5

total points		100.00