BRICS 2022 CHINA

2022 BRICS Skills Competition

(BRICS Future Skills Challenge)

TECHNICAL DESCRIPTION

Mobile Robotics(Offline)

Catalogue

1. Project introduction

1.1 Project Description

Today's society has attached great importance to the sustainable development and reuse of resources, and garbage classification has long been an indispensable part of it. People consume a lot of resources and generate a lot of waste. How to turn waste into treasure, waste sorting and recycling is a good way out. Combined with intelligent robot technology, the efficiency of garbage sorting and recycling can be improved.

The Waste Sorting Management Robot Competition requires a team of two students / entrants to design and build a robot that can efficiently collect materials from various homes and deliver them to recycling centers. Robots must be able to operate autonomously. Many elements can be introduced or removed to make this challenge more difficult or easier, for example: introducing traffic, adding buildings, reducing road size, etc.

Therefore, the contestants of this project need to maintain and develop the mobile robot body and application according to the requirements of the topic, and fully tap the potential of the mobile robot.

1.2 Purpose of the assessment

This competition is aimed at the requirements of the transformation and upgrading of the equipment manufacturing industry for the improvement of job skills. The content of the competition is designed around the real work process, tasks and requirements. Solve the contradiction between the rapid growth of the robot industry and the serious shortage of professional talents through skills competitions, improve the level and number of skilled robot talents, and serve the field of intelligent manufacturing.

2. The ability of the player

2.1 basic requirements

A. Work organization and management	The individual (player) needs to know and understand: Manufacturing-related safety work macro principles and applications; equipment and materials use, use, maintenance, maintenance and safe practices; Working environment and safety rules, keep the working environment clean; Work collaboratively; communicate (parameters) the content of each task that needs to be planned. The individual (player) should be able to: prepare and maintain a safe, clean and efficient workplace;

	be prepared for the relevant work, taking into account occupational health and safety factors; Arrange work to ensure maximum efficiency and minimum disruption; Consider and comply with the relevant rules and regulations of robotics engineering; Select and use equipment and materials safely in accordance with the manufacturer's instructions; Comply with environmental, equipment, material related health and safety or higher relevant standards. Tidy up the workplace and restore it to a tidy state; Participate in team work and contribute in specific tasks; Give and receive feedback and provide support.
B. Robot installation and maintenance	The individual (player) needs to know and understand: Fundamentals of mechanical, electrical and electronic engineering; The principle of production and assembly; Principles and practices for safe manufacturing and operation. The individual (player) should be able to: Complete the fabrication of the frame parts of the mobile robot; The integration of mobile robot structure and mechanical parts; Integration of electronic control circuits; Installation, configuration and production and effective use of related physical (hardware) and software adjustments; Installation, setup and necessary adjustments of mechanical, electrical and sensor systems; Installation, setting and production of remote control system to realize effective remote control of mobile robots; Identify the sensors required to complete the control task.
C. Programming, testing and adjustment	The individual (player) needs to know and understand: How the manufacturer's control software is programmed using standard industry software; How software programs relate to mechanical and system actions; The principle and application of wireless communication; Robot navigation through guidance and map construction; sensor information fusion; Troubleshooting and analysis skills; Skills in making adjustments and repairs; problem solving strategies; Principles and techniques for inventing innovative solutions. The individual (player) should be able to: Graphicalize the process and software operation, use the control program to control the target control system autonomously and effectively; Use industry-standard programming software to autonomously and effectively control robot movements; Use remote control to effectively control the system; Use programming method to realize the control of the system; Through the guidance and map construction functions, the robot motion control is realized;

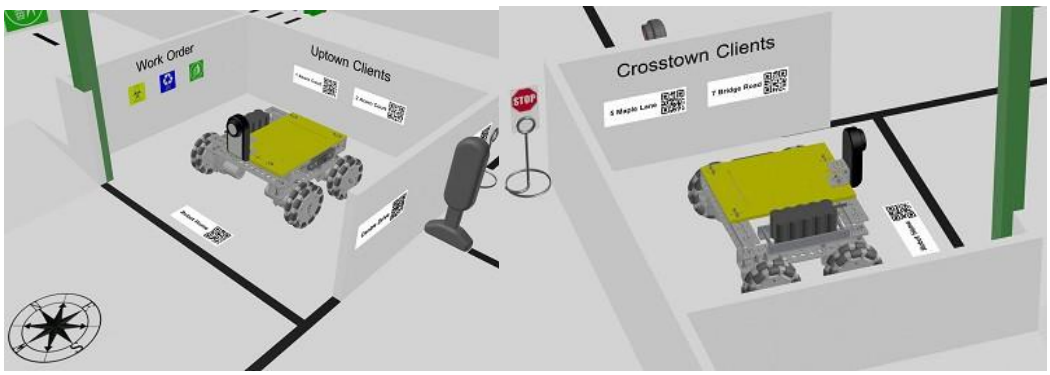
	implement a navigation strategy; Install and adjust the hardware settings of the sensor; Install a camera on the robot and make appropriate adjustments; Trial operation of individual functions as well as overall functions; Find and document faults using appropriate analytical techniques; Demonstrate basic IT knowledge; Repair or replace components quickly and easily.
D. Comprehensive task demonstration	The individual (player) needs to know and understand: Requirements and methods for testing equipment and systems; Requirements and methods of operating test runs; the scope and limitations of the techniques and methods used; creative thinking strategies; Redundancy performance of robotic systems. The individual (player) should be able to: Test each component of the mobile robot according to the operational requirements (negotiated with the customer); Test the overall performance of the mobile robot according to the operational requirements (negotiated with the customer); Through analysis, problem solving and fine-tuning, the individual parts of the system and the overall system operation are optimized; Carry out trial operation of the system through the final test; Examine every aspect of the design process, manufacturing and assembly, and operation, including items such as accuracy, consistency, time-consuming, and cost, according to set requirements;

3. Competition items

3.1 Competition venue

3.1.1 Task assignment area

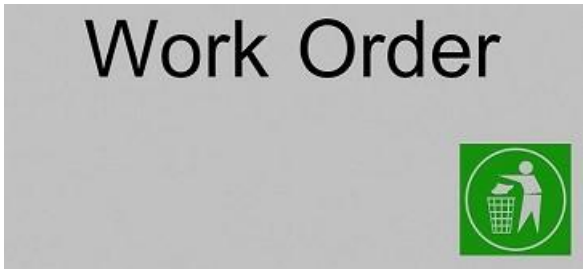
The task allocation area is the home of the robot and the starting point for executing tasks. It is used to place the types of garbage to be recycled and customer information, and it is also the starting area of the robot.



1. assignment area is a 705 X 600 mm open space
2. 600mm wide inlet/outlet.
3. displayed in the Work Order defines the item types managed by the robot for this task .
4. Uptown Clients wall shows the first part of the client area. If the client name exists, the client is included in the current work order. If the name does not exist, the client is not included in the current work order.
5. Crosstown Clients wall shows the second part of the client area. If the customer name exists, the customer is included in the current work order. If ″ does not exist ″ , the customer is not included in the current work order.
6. The robot needs to ″ read ″ the work order display to determine the specific task the robot must perform.

3.1.2 Site identification

Each material identification in the work order has a fixed display position, the material identification size is 7 cm*7 cm, and the distance from the ground is 12 cm . When there are three material identifications, the distance between them is 3 cm , and they are displayed in the center on the wall.

<table>
<tr><td> 
</td><td></td></tr>
<tr><td> 
</td><td>The size of the material identification placed in the recycling center is 18 cm * 18 cm, and the position is centered and flush with the top of the wall</td></tr>
<tr><td> 
</td><td>The size of the QR code in the upper urban area and the cross-city area is 5 cm * 5 cm, the distance from the ground is 12 cm, the cutting size is 21 cm * 5 cm, and it is displayed in the center on the wall.</td></tr>
<tr><td> 
</td><td>The QR code size of 4 street signs and 6 location signs is 5cm *5cm, the cut size is 21cm * 5cm, and the distance from the ground is 15cm.</td></tr>
</table>

3.1.3 "Garbage" Sorted Collection

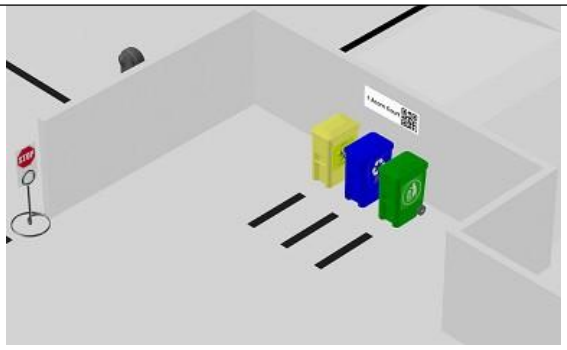
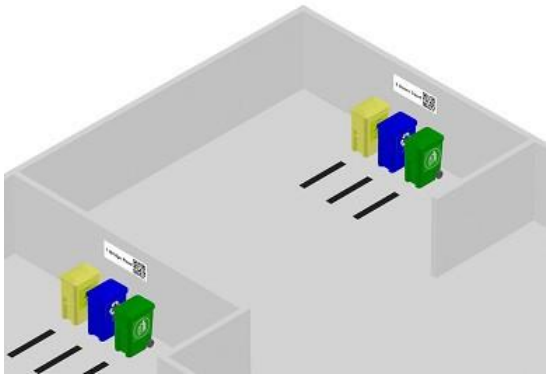
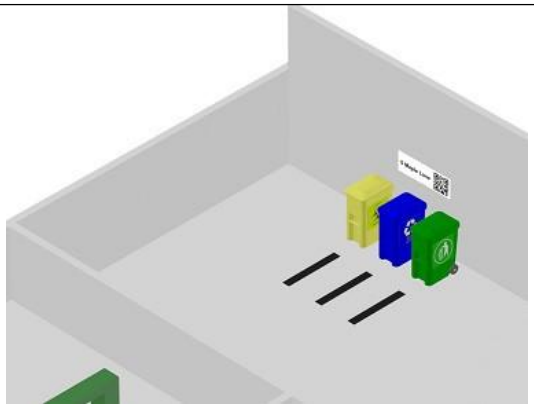
There are four target customer areas, and the robot needs to go to different areas for "garbage" classification and collection according to the task requirements.

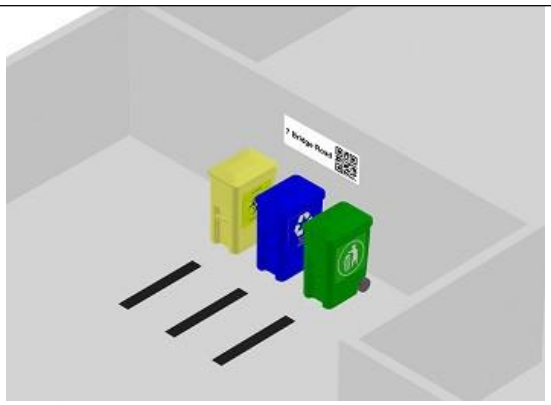
Each target customer area:

1. The blue box is placed in the middle, the green box is placed on the right, and the yellow box is placed on the left
2. Each bin has a 150mm long by 19mm wide black tape line leading to the centre of the bin
3. The center of the blue box is 300mm to the left or right of the nearest wall
4. Use the same 125 x 87 x 60mm yellow, blue and green bins

5. Provide at least 600 x 700 mm of open space in front of the bin group
6. hollow ball weighs 3 grams
7. Robots must retrieve the contents of the bins in the customer area and deliver them to the corresponding containers in the recycling center.
8. The robot has to ensure that the various "trash" (golf balls of different colors/types) never touch each other during the collection/delivery process or in the final destination bin at the recycling center.

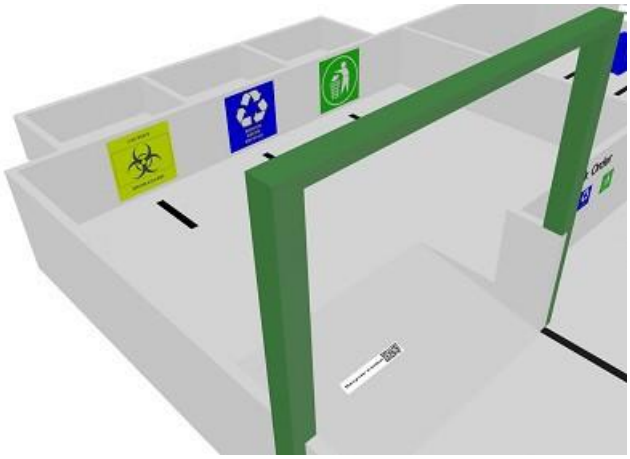
NOTE: The robot cannot remove any bins from the client area at any time.

	1 Acorn Court
	2 Acorn Court
	5 Maple Lane

	7 Bridge Road

3.1.4 Recycling " garbage " centers

1. The recycling center area is 1200 × 800 mm .
2. The entrance provides a 600mm wide space.
3. Along the outside of the 1200mm rear wall are three 308 x 210 x 100mm storage compartments .
4. Each of these boxes has an icon for the label they support and a black duct tape line leading to the center of the box.



3.1.5 " Junk " material

1. Biohazardous Materials - Yellow Trash Can - Yellow Hollow Ball
2. Reuse Materials - Blue Trash Can - Blue Hollow Ball
3. Hazardous Materials - Green Trash Can - Green Whiff Ball

3.2 Competition module

Module number	Mobile Robotics		
	module name	Score	Judgment criteria

A	Work organization and management	6	Venue and Time Management / Team Performance
B	Robot installation and maintenance	4	On-site assessment based on robot assembly results
C	Programming, testing and tuning	40	Judgment according to task debugging standards
D	Comprehensive Mission Demonstration	50	Judgment according to task debugging standards
total		100	

3.3 The way of proposition

The competition is divided into 4 modules. A module, work organization and management; B module, robot assembly and maintenance ; C module programming, testing and adjustment; D module, comprehensive task demonstration. Modules A and B are scored by special referees, modules C and D are scored by the referees, and the test questions of modules C and D are provided on-site, and the sample questions are used as a reference. There are no more than 30% changes, and the changes are completed by the chief referee independently.

3.4 Number of examinations

This stage is a centralized assessment with a weight of 100%.

3.5 Sample contest questions

Competition content	Rating content	Scoring requirements
Module A: Work Organization and Management (6 points)	Cooperative behavior with teammates, opponents, and experts	Be courteous among players, their teammates, opponents and supervising referees
	Venue situation	Competitor's workplace order/tools and accessories placement/workspace order
	Plan implementation	Competitors must complete relevant tasks in strict accordance with the requirements of the competition schedule at the specified time and place and accept supervision
Module B: Robot Assembly and Maintenance (4 points)	Robot installation and maintenance	Complete the debugging of the robot within the specified time, and do not damage the robot during the competition
Module C: Programming, Testing and Tuning (40	Under known conditions, the robot completes the specified task	Complete scheduled actions as required
	Under known conditions, the robot completes intermittent tasks	

points)	Robots complete intermittent tasks under unknown conditions	
	In the simulation environment, the robot completes autonomous movement	
Module D: Integrated Task Demonstration (50 points)	Unknown task automatic test 1	Able to correctly load the user's garbage onto the garbage truck Able to correctly place the garbage on the garbage truck to the designated location After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off. The degree of task completion includes the total time spent
	Unknown task auto test 2	
	Unknown task automatic test 3	
	Unknown Task Autotest 4	

Module A: Work Organization and Management

In terms of work organization and management, the basic quality of the contestants is mainly assessed, including the management of the team's workspace during the competition, the punctuality in the work process, the cooperation and communication of the contestants in the field, and the sharing of the field with other participants. The cooperation of the players and the performance of the players in the communication process with the referee.

serial number	Judging Rules
A	Cooperative behavior with teammates, opponents and experts on game day.
	Condition of the team's field on the match day.
	The implementation of the game day plan.

Module B: Robot Assembly and Maintenance

serial number	Judging Rules
B	Complete the installation of the robot within the specified time.

Module C: Programming, Testing and Tuning

Basic task tests are conducted in a known field layout. "Customers" and "Trash" will be drawn in 3 groups each and announced in the morning.

C2 draws a set of "customers" and "garbage" from possible orders before programming begins. C 3 After the robot program is downloaded, one contestant selects a group from the remaining "customer" and "garbage" groups, and the other contestant starts the robot according to the instruction to start the test. (Note: each rubric is only completed and incomplete, no partial

completion)

serial number	content	Judging Rules
C1	Under known conditions, the robot completes the specified task	Control the drive motor to rotate clockwise and counterclockwise through the buttons on the front panel
		When the robot is in the designated starting area, the linear motion is 100cm, with an error of ±10cm
		Demonstration of motor rotation speed controllable via front panel
		The robot rotates 90° clockwise, with an error of ±10°
		The robot moves horizontally by 100cm in the designated starting area, with an error of ±10cm
		Demonstration robot reads ultrasonic and infrared ranging sensor data
		Demonstration of robot 90° correction
C2	Under known conditions, the robot completes intermittent tasks	Can automatically reach the front of the trash can at the designated user location
		Can automatically grab the specified trash can
		Can automatically load the garbage in the designated trash can
		Can automatically put garbage in the designated recycle bin
		It can move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off
C3 _	Robots complete intermittent tasks under unknown conditions	Can automatically reach the front of the trash can at the designated user location
		Can automatically grab the specified trash can
		Can automatically load the garbage in the designated trash can
		Can automatically put garbage in the designated recycle bin
		It can move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off
C4	In the simulation environment, the robot completes autonomous movement	Complete the construction of the simulation scene
		Can automatically reach the front of the designated grab point
		Can automatically grab the specified object
		Can automatically load the specified object to the front of the placement point
		Can automatically place objects in a specified location
		Can automatically reach the front of the designated grab point
		Can automatically grab the specified object
		Can automatically load the specified object to the front of the placement point
		Can automatically place objects in a specified location

Module D: Integrated Task Demonstration

The comprehensive function test mainly evaluates the players' comprehensive control ability of the robot and their ability to adapt to the field and test environment in a short time. The players need to write automatic programs, debug and demonstrate according to the specific conditions of

the field. The referee team will make a result judgment based on the actions performed by the robot. Module D is an unknown automatic comprehensive function test. Two "customer" and "garbage" are selected and announced in the morning. Among them, D 1 and D 2 of the unknown automatic comprehensive function test were conducted in a known field layout, and D 3 and D 4 were conducted in an unknown field layout, which was announced on the morning of the game.

In order to achieve garbage classification, during the comprehensive task test, the robot can only recycle a single type of garbage from a single customer at a time.

unknown automatic comprehensive function test , after the robot downloads the program, the contestant should not touch the robot or the computer except to start the robot to run. The robot needs to complete the specified task in complete autonomy.

Automatic comprehensive function test for unknown conditions, specifying the order in which the "garbage" of the "customer" is transported to the recycling station, the robot needs to transport the correctly loaded "rubbish" to the corresponding recycling station in sequence, and then return to the parts department to turn off the indicator light, and the task is completed. The robot needs to scan the label and code to obtain the "customer" information and the type of "garbage" that needs to be loaded. The delivery order will not be announced to the players in this round of testing until the players have downloaded the program and started the robot.

Robots complete tasks in sequence by scanning codes and recognizing trash icons.

Automated Comprehensive Functional Test Score Sheet

serial number	content	Judging Rules
D1	Completion evaluation of autonomous continuity tasks under unknown conditions1	Correctly load the "junk" of "Task 1".
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.
		Correctly load the "junk" of "Task 2".
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.
		Correctly install the "junk" of "Task 3".
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.
		Correctly load the "junk" of "Task 4".
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.
		Task completion includes total time spent.
D2	Under unknown conditions, evaluation of autonomous continuity	Correctly load the "junk" of "Task 1".
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.
		Correctly load the "junk" of "Task 2".

	task completion degree 2	Properly deliver the "Trash" of "Task 2" to the designated recycle bin.
		Correctly install the "junk" of "Task 3".
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.
		Correctly load the "junk" of "Task 4".
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.
		Task completion includes total time spent.
D3	Completion evaluation of autonomous continuity tasks under unknown conditions 3	Correctly load the "junk" of "Task 1".
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.
		Correctly load the "junk" of "Task 2".
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.
		Correctly install the "junk" of "Task 3".
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.
		Correctly load the "junk" of "Task 4".
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.
		Task completion includes total time spent.
D4	Completion evaluation of autonomous continuity tasks under unknown conditions4	Correctly load the "junk" of "Task 1".
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.
		Correctly load the "junk" of "Task 2".
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.
		Correctly install the "junk" of "Task 3".
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.
		Correctly load the "junk" of "Task 4".
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.
		Task completion includes total time spent.

4. Scoring criteria

The evaluation criteria for this project are divided into two categories: measurement and

evaluation. Any judgment that can be expressed by objective data is called measurement; any judgment that needs to be expressed by subjective description is called evaluation. Except for time, all other measurement points are taken into the final score as the player's basic score. The score calculation and summary score of this competition shall be reserved to the second decimal place.

4.1 Description of the scoring process

In order to ensure the fairness and impartiality of the scoring process, the scoring process adopts an avoidance system, and each referee does not participate in the scoring of their own players. Except for avoiding the referee, all other referees participated in the refereeing. Before the start of the competition, the chief referee organizes and assigns the task of refereeing. The referee without the task of refereeing shall not enter the player's position, and shall not have any communication with his players during the refereeing process (except during the noon break). The A/B/C/D modules are scored, and the judging process is completely scored according to the scoring criteria.

scoring method of Judgement is as follows: 3 judges are in a group, each of them will score independently, calculate the average weighted score, divide by 3 and then multiply by the score of the sub-item to calculate the actual score. The difference between the judges must be less than or equal to 1 point, otherwise the exact reason needs to be given and the score will be adjusted under the supervision of the team leader or the referee.

The weight table of the working environment of the competition venue is as follows :

weight score	Description of requirements
0 marks	Workspace is always cluttered
1 point	Normal working environment
2 minutes	Good working environment
3 points	Work area organization is excellent

Measurement scoring method: set up several scoring groups according to the module, each group consists of 3 or more judges. All judges in each group will discuss together, and only one score will be given after reaching an agreement on the actual score of the player in this item. If the number of referees is large or small , another grouping mode can also be determined.

A sample table of measurement scoring criteria:

type	Example	highest score	correct score	incorrect score
full or zero	Automatically grab 1 trash can	1	1	0

Time points (Time) scoring method: Time points are only for those teams that complete all

tasks in accordance with the requirements of the game, and the time is less than 600 seconds (10 minutes). When the referee evaluates the time division, fill in the time used by the team to complete the task on the scoring sheet, and calculate the time point in the unified scoring system through the following formula:

$$\text{Team Score} = \left(1 - \frac{\text{队伍时间} - \text{最快队伍时间}}{\text{最多用时} - \text{最快队伍时间}}\right) \times \text{Highest Score}$$

A sample time-point scoring rubric:

type	most time	highest score	Score	no score
time points	600 seconds	2	Time ≤ 600 seconds	Task not completed within 600 seconds

4.2 Statistical method

After all the scoring items in the assessment are completed and all contestants confirm, they will be reviewed and confirmed by the chief referee and entered into the system by the staff. The total score is based on the sum of the scores , ranking from high to low. In the final assessment, when it comes to the equal distribution of the selected places, follow the steps below:

1. If the total score is equal, the ranking will be based on the score of module D;
2. If the scores of module D are equal, the ranking will be given priority according to the higher scores of module C;
3. If the scores are still equal, an additional round of automatic tasks will be played.

4.3 Robot Control Mode

Intermittent test (C2、C3) :

The robot control program is downloaded to the robot;

During the formal test, the contestants need to explain to the referee the goal of completing the task before each test. After the referee allows, press the enter key of the laptop or the button on the robot to start. After the task is completed, the robot needs to stand still, and the referee will confirm it. Proceed to the next item.

Automatic control mode:

The robot control program is downloaded to the robot;

During the official test, participants are not allowed to interact with the robot and the computer;

The start of the test can be the enter key on a laptop or a button on a robot.

4.4 Scoring Rules

C project scoring rules:

serial number	content	Judging Rules	Score
C1	Under known conditions, the robot completes the specified task	Control the drive motor to rotate clockwise and counterclockwise through the buttons on the front panel	1
		When the robot is in the designated starting area, the linear motion is 100cm, with an error of ±10cm	1
		Demonstration of motor rotation speed controllable via front panel	1
		The robot rotates 90° clockwise, with an error of ±10°	1
		The robot moves horizontally by 100cm in the designated starting area, with an error of ±10cm	1
		Demonstration robot reads ultrasonic and infrared ranging sensor data	1
		Demonstration of robot 90° correction	1
C2	Under known conditions, the robot completes intermittent tasks	Can automatically reach the front of the trash can at the designated user location	1
		Can automatically grab the specified trash can	1
		Can automatically load the garbage in the designated trash can	1
		Can automatically put garbage in the designated recycle bin	1
		It can move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off	1
C3 _	Robots complete intermittent tasks under unknown conditions	Can automatically reach the front of the trash can at the designated user location	1
		Can automatically grab the specified trash can	1
		Can automatically load the garbage in the designated trash can	1
		Can automatically put garbage in the designated recycle bin	1
		It can move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off	1
C4	In the simulation environment, the robot completes autonomous movement	Complete the construction of the simulation scene	3
		Can automatically reach the front of the designated grab point	2
		Can automatically grab the specified object	3
		Can automatically load the specified object to the front of the placement point	3
		Can automatically place objects in a specified location	2
		Can automatically reach the front of the designated grab point	2

		Can automatically grab the specified object	3
		Can automatically load the specified object to the front of the placement point	3
		Can automatically place objects in a specified location	2

D project scoring rules:

serial number	content	Judging Rules	Score
D1	Completion evaluation of autonomous continuity tasks under unknown conditions1	Correctly load the "junk" of "Task 1".	1
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 2".	1
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.	1
		Correctly install the "junk" of "Task 3".	1
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 4".	1
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.	1
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.	2.5
		Task completion includes total time spent.	2
D2	Under unknown conditions, evaluation of autonomous continuity task completion degree 2	Correctly load the "junk" of "Task 1".	1
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 2".	1
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.	1
		Correctly install the "junk" of "Task 3".	1
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 4".	1
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.	1
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.	2.5
		Task completion includes total time spent.	2
D3	Completion evaluation of autonomous continuity tasks under unknown conditions 3	Correctly load the "junk" of "Task 1".	1
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 2".	1
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.	1

		Correctly install the "junk" of "Task 3".	1
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 4".	1
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.	1
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.	2.5
		Task completion includes total time spent.	2
D4	Completion evaluation of autonomous continuity tasks under unknown conditions4	Correctly load the "junk" of "Task 1".	1
		Properly deliver the "Trash" of "Task 1" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 2".	1
		Properly deliver the "Trash" of "Task 2" to the designated recycle bin.	1
		Correctly install the "junk" of "Task 3".	1
		Properly deliver the "Trash" of "Task 3" to the designated recycle bin.	1
		Correctly load the "junk" of "Task 4".	1
		Properly deliver the "Trash" of "Mission 4" to the designated recycle bin.	1
		After completing the tasks in order, move to the starting area autonomously, the chassis is projected in the starting area, and the switch of the robot indicator light is turned off.	2.5
		Task completion includes total time spent.	2

5. Competition related facilities and equipment

5.1 Site Equipment

serial number	device name	Model (remarks)	quantity
1	table 1	2000x600x750mm	n
2	chair 1	office chair	2n
3	Station power socket	Five-hole socket	n
4	Competition Venue and Venue Items	WSR2021	6
5	Competition venue socket	220V, 50Hz five-hole socket	4
6	tool table	anti-static	1
7	multimeter	Victory VC Series	6
8	sanitary tools	Plastic material	6

9	white paper	A4	5
10	stopwatch	timing	
11	dice	for lottery	4
12	Display 1	lecture	1
13	Display 2	timing	1
14	printer		1
15	Intelligent simulation terminal		n
16	move robot	HG KNIGHT-BRICS	n

(n: number of participating teams)

5.2 Equipment and tools provided by the competitor

serial number	device name	Remark	quantity
1	robot	You can use the equipment provided on site, or you can provide your own robot, and the self-provided equipment must comply with the provisions of 5.4.	1
2	laptop		2
3	toolbox		1

5.3 The venue is prohibited from bringing your own equipment and materials

serial number	Equipment and material names
1	electrical tools
2	Storage devices, such as mobile hard drives, voice recorders, etc.; Electronic devices, such as tablets, mobile phones, multimedia players, recorders, cameras, video cameras, etc.
3	Items with identification marks

5.4 Robots for competition

The robot model of the competition is: HG KNIGHT-BRICS . The participating units can bring their own robots and must meet the following parameters:

1. Using the HG KNIGHT-BRICS robot, it can complete the task of garbage classification competition.
2. Main Controller: Studica VMXPi
3. Drive: Studica Titan Quad Motor Controller

4. Movement management system: The HG KNIGHT-BRICS robot adopts a three-wheeled omnidirectional chassis, and the mechanical structure of the motion chassis is stable and durable.
5. Target management system: The HG KNIGHT-BRICS robot adopts a two-degree-of-freedom target management system design based on the competition task, which can grip the waste bin and store the waste in the waste bin into the waste storage, which is simple and quick to operate.
6. Vision system: The camera is matched with the solution of the HGVISION vision module, which can identify barcodes, golf balls, etc. required by the challenge.
7. Sensing system: The robot is equipped with 2 infrared ranging sensors, 2 ultrasonic ranging sensors, 1 QTI line patrol sensor, travel switches, gyroscopes, etc. allowed by the competition technical documents.
8. Programming language: NI LabVIEW graphical programming language
9. The HG KNIGHT-BRICS robot is built using the 2 022 Shanghai World Championship kit and Shanghai accessory kit.
10. ″ Contestant-designed / created custom components ″ into their robot designs subject to the following restrictions:
    i. All 3D printing elements must use ABS, PLA, Nylon, PETG, HIPS, ASA or carbon fiber (3D printing material with carbon brazing), with a maximum total weight of 1.2kg.
    ii. All components developed using sheet metal must be created using any polycarbonate material with a total table size of up to 1000 by 1000 mm (maximum thickness 10 mm).
    iii. Competitors will bring custom components built by these competitors to the field.
    iv. The day before the competition, all entrant-built custom components will be inspected to ensure entrants are adhering to these restrictions. If contestants exceed these limits, they will be required to modify their robot designs to conform to these limits before being allowed to compete.
    v. Competitors can also bring custom cables and wires required for the wiring of the robot.
    vi. Competitors are required to carry three copies of the micro SD card used on the VMX. This is because there are no restrictions on the Internet site, This means that all packages and software must be installed in advance.

6. Project special provisions

6.1 Equipment Regulations

1. Robots used by contestants must comply with the provisions of 5.4.

2. Competitors are only allowed to use one computer to control the robot during practice and testing on the field.
3. The competition site does not provide WIFI equipment and signals. If you need to use it, you will be responsible for the impact on the participating equipment.
4. During the debugging and programming process, the robot must be placed on a bracket or a special debugging board and on the field. This ensures that the robot does not separate from the work area even in the event of a sudden and unexpected movement of the robot drive system.

6.2 Other requirements

1. Each team can bring up to 2 computers into the competition area;
2. On the first day of the competition, participants must bring their own computers and robots into the competition area, and they cannot take them out of the field until the end of the competition;
3. Participants are not allowed to bring mobile phones and other communication tools into the venue;
4. Competitors cannot connect to the Internet in the competition area;
5. Competitors may carry and use programs they have written during competition preparation.

7. Field layout requirements

7.1 Venue and materials

The competition area has a waiting area and a competition area. The waiting area includes the inspection room and the waiting room, while the competition area includes the competition arena (including the preparation room: completing the reading test questions and preparing materials).

7.2 Competition Venue and Venue Items

The same day venue for this competition remains unchanged.

1. Field items include trash (hole balls), recycling bins, "clients", "trash cans".
2. 3 identical practice balls will appear in the "Trash Can".
3. 3 types of garbage will appear in each "client".

8. Health safety and green environmental protection

8.1 Player safety protection requirements

1. Contestants should strictly abide by the equipment safety operation rules.
2. When the contestants stop operating, they should ensure the normal operation of the equipment. After the competition, all equipment should be kept in running state. Do not disassemble or move the hardware connection to ensure the normal operation of the equipment and normal scoring.
3. Contestants should operate in accordance with safety regulations, such as: ESD (Electrostatic Discharge), use of equipment in an ESD-safe environment, safe use and storage.
4. Competitors should ensure that equipment and information are complete and secure.

8.2 Event Safety Requirements

1. Competitors and all participants are prohibited from bringing any toxic and harmful substances into the competition site.
2. The organizer should set up a special security team to be responsible for health and safety affairs during the competition. It mainly includes checking the safety and defense of the competition venue, the residence of the participants, the vehicle traffic and the surrounding environment; formulating an emergency response plan; supervising the food safety and hygiene of the participants; analyzing and handling safety emergencies, etc.
3. The arena must be equipped with corresponding medical personnel and first aid personnel, and corresponding first aid facilities shall be provided.

9. Field requirements _

9.1 Public Requirements

1. Except for the designated referees, technical support, players, and staff, no other personnel are allowed to enter the arena.

2. Those who are allowed to enter the arena by the organizer can only observe the competition in the safe area.
3. Personnel allowed by the organizer to enter the arena shall abide by the rules of the arena, shall not talk to the players, and shall not hinder or interfere with the competition of the players.
4. Personnel allowed by the organizer to enter the arena are not allowed to smoke or make noise in the arena.
5. The venue shall ensure that no personnel obstruct or interfere with the competition of the players around the venue, and there shall not be any behavior that affects the fairness and impartiality of the competition.

10. Go green

1. Environmental protection.
2. The venue strictly abides by my country's Environmental Protection Law.
3. All waste in the venue should be effectively sorted and disposed of, and recycled as much as possible.

Appendix 1: Known layout