BRICS 2022 CHINA

Sample questions (offline)

BRICS-FS-17_Mobile Robot

2022 BRICS Skills Competition

Important Notes

1. The game time is 210 minutes.

2. The competition consisted of 4 modules, accounting for 100% of the total score, as shown in Table 1.

Table 1 Competition tasks

Serial number	Name	Score share	Description
1	Module A: Work Organization and Management	6%	
2	Module B: Robot Assembly and Maintenance	4%	
3	Module C: Programming, Testing and Tuning	40%	
4	Module D: Integrated Tasks and Presentations	50%	
	Total	100%	

3. The nodes for judging are indicated in the rotation table. For each task that needs to be accepted by the judge, please indicate the judge to judge in the corresponding scoring time period after completing the corresponding

task, and please confirm the completion of acceptance according to the requirements of the competition.

4. Please make sure to read the important tips for each task.

5. During the competition, the contestants must strictly abide by the safety operation specification. If an accident occurs that endangers the safety of the equipment or the person, the competition will be stopped immediately and the contestant will be disqualified.

6. Players should raise their hands to indicate the part of the competition that needs to be confirmed by the judges.

7. Contestants are not allowed to use USB flash drives during the competition.

8. Players should abide by the relevant rules and regulations and safety codes during the competition, and if they violate them, the corresponding points will be deducted from the total score of the competition in accordance with the relevant regulations.

9. Before the start of the competition, the contestant should check the equipment at the work station carefully against the tool list and confirm the start of the competition; after the contestant has completed the task, the inspection tools, instruments and parts should be collected and then provided to other contestants.

10. The contestants need to keep the competition space neat and clean and restore the site after use.

11. maintain a neat and safe working environment in their assigned work space

12. Strictly abide by the competition schedule.

13. Contestants are strictly prohibited to bring any communication, storage devices and technical data, if found, they will be disqualified from the competition. The contestant will be disqualified if he/she leaves his/her team's place or communicates with other contestants or makes loud noises in the field, which seriously affects the order of the field.

14. The contestant must keep the program and materials written by himself/herself in time to prevent the loss of program or materials caused by unexpected power failure or other circumstances.

15. No items provided by the competition venue can be taken away from the competition venue.

16. The competition venue is described as follows.:

Site map: As shown in the known site and Figure 1 in Appendix 1, the site is simulated as a garbage recycling scene, the actual use of 2000mm x 4000mm "garbage recycling environment" site.

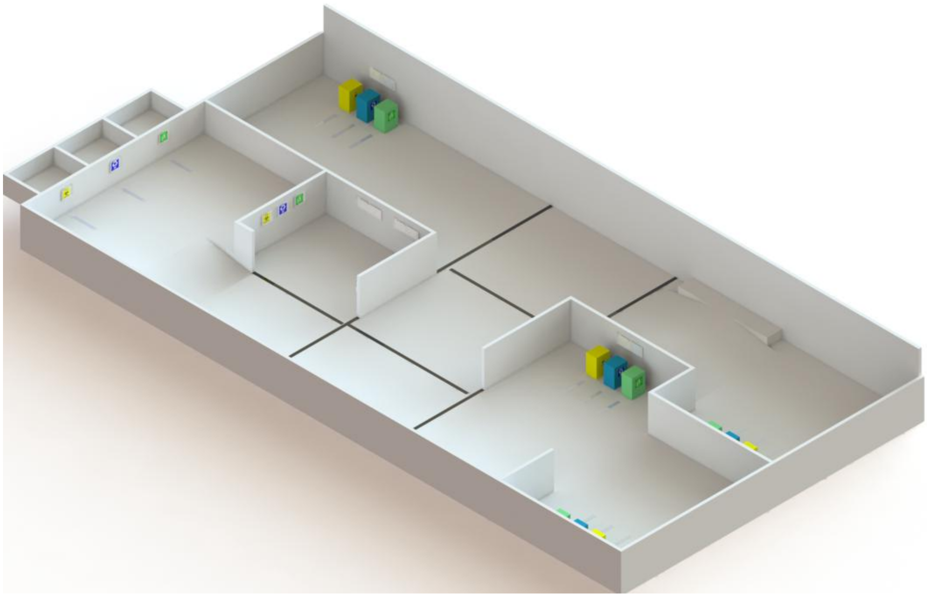
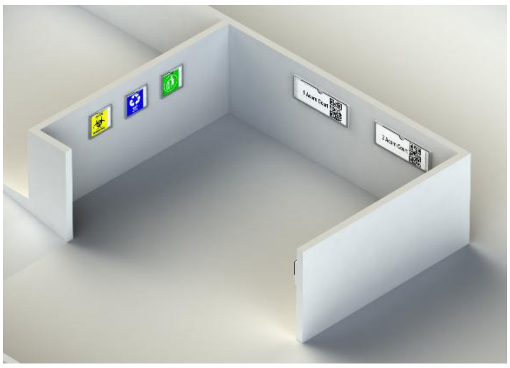


Figure 1 Environmental competition site for waste recycling

The site contains the task allocation area, site signage, "garbage" sorting and collection customers, recycling "garbage" center, garbage cans and "garbage" materials. Among them:

(1) Task assignment area: The robot's home and the starting point of the task, used to place the type of garbage to be collected and the customer's information, as well as the robot's start-up area. As shown in Figure 2



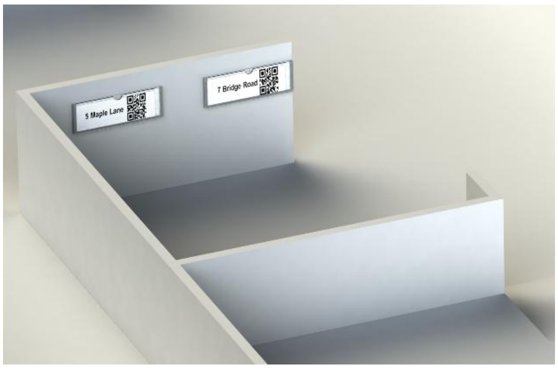
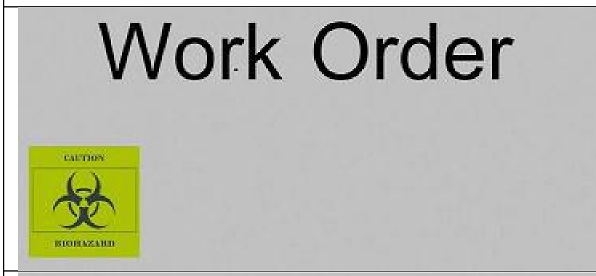
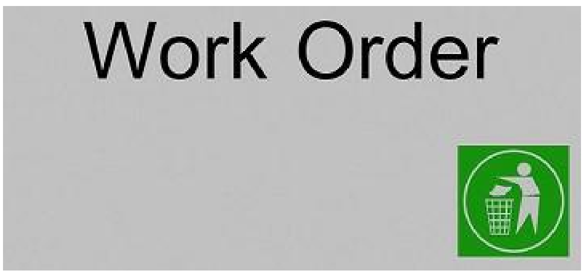


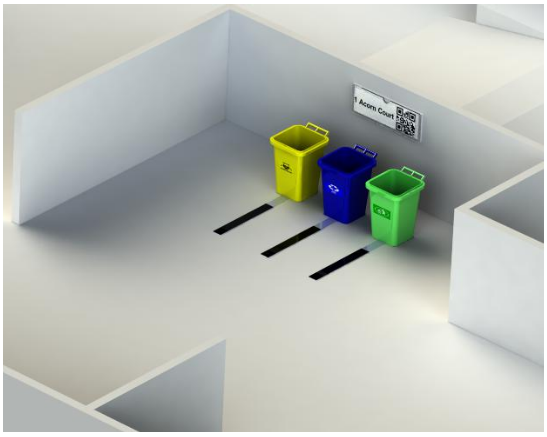
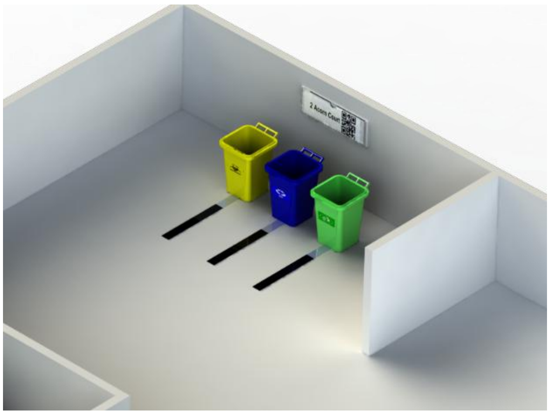
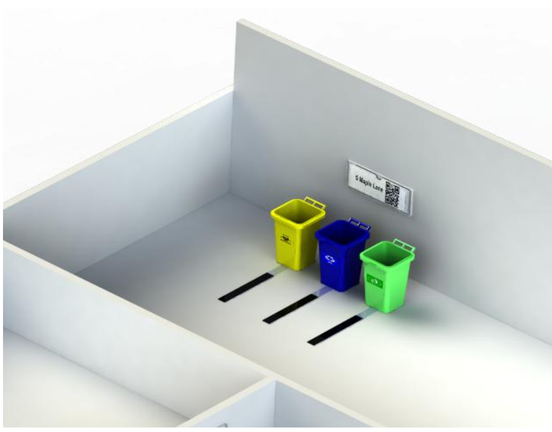
Figure 2 Task assignment area

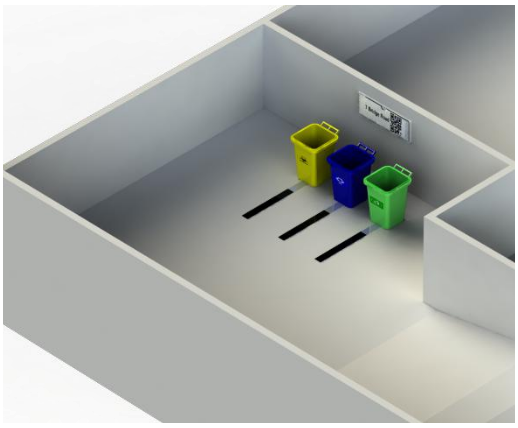
(2) Site identification: the elements and definitions are as follows

<table>
<tr><td></td><td rowspan="4">Each material sign in the work order has a fixed display position. The size of the material sign is 7cm*7cm, 12cm from the floor, and the spacing between them is 3cm when there are three material signs, and they are centered on the wall where they are displayed.</td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
<tr><td></td></tr>
</table>

	The size of the material sign placed in the recycling center is 18cm*18cm, centered and flush with the top of the wall
	The uptown and cross-town QR codes are 5cm*5cm in size, 12cm from the ground, cut to 21cm*5cm in size, and centered on the wall where they are displayed.
1 Acorn Court	The size of the QR code of 4 customer signs is 5cm*5cm, the cut size is 21cm*5cm, and the distance from the ground is 15cm.
2 Acorn Court	
5 Maple Lane	
7 Bridge Road	

(3) Separate collection of "garbage": the elements and definitions are as follows

	1 Acorn Court
	2 Acorn Court
	5 Maple Lane

	7 Bridge Road

(4) Recycling "garbage" center: as shown in Figure 3

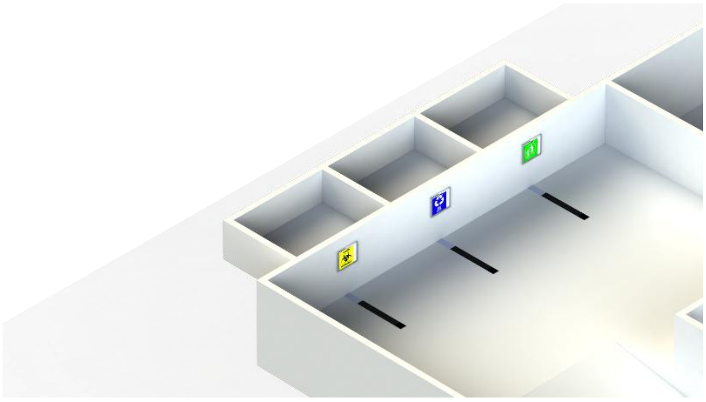


Figure 3 Environmental competition site for waste recycling

(5) Garbage cans and "garbage" materials:

Biohazard Material - yellow bin - yellow hollow ball;

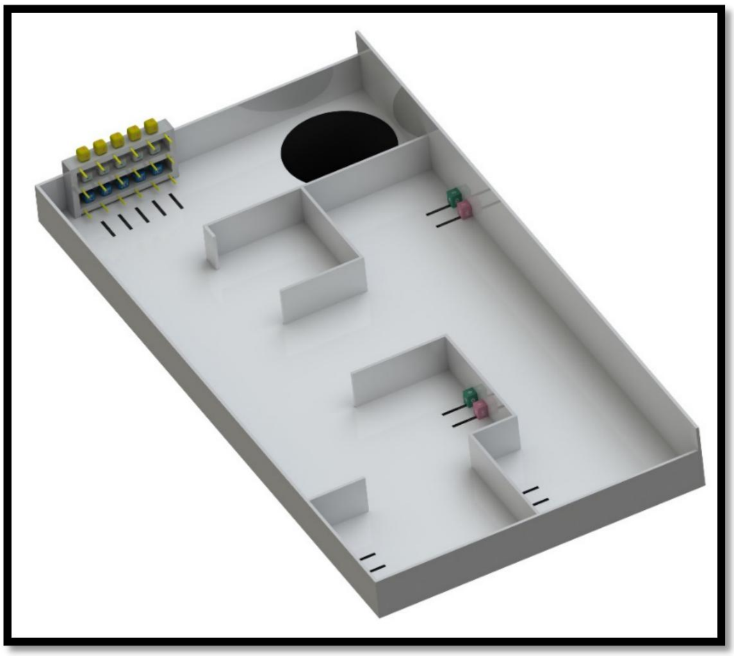
Recycle Material - blue bin - blue hollow ball;

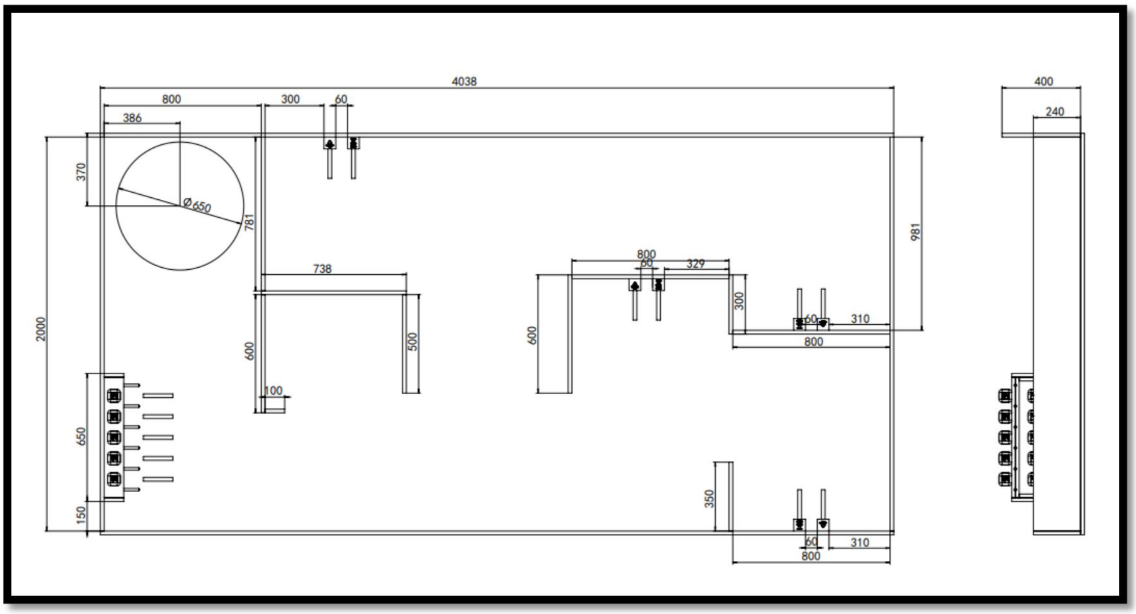
Waste Material - green bin - green hollow ball;

As shown in Figure 4:

Figure 4 Garbage cans and "garbage" materials

Competition simulation site:





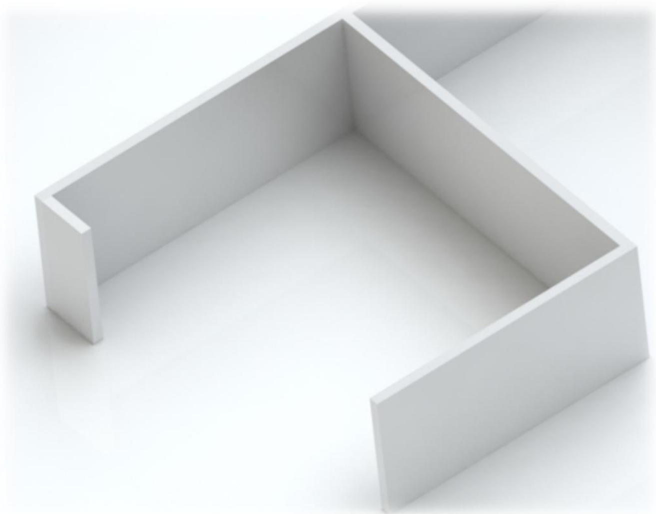
The layout of the waste sorting site presents the cities where the mobile robot provides support for waste sorting management and disposal.

a) In different cities, the streets will be different, so the mobile robot has to be able to adapt to different scenarios, and the current site is the layout of one of the announced sites.

b) The number of customers who can dispose of waste varies from city to city, with a total of four customers in the currently announced sites, each with two disposal bins.

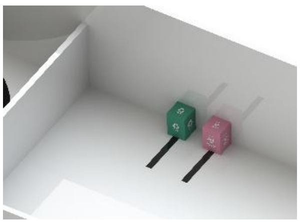
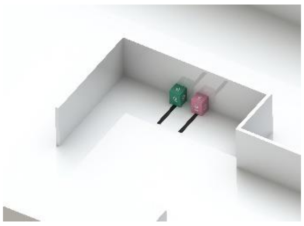
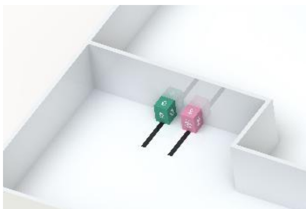
Robot starting point:

The mobile robot needs to start at that place, i.e. the robot's start-up area.



″Garbage″ distribution treatment:

There are four target customer areas in the announced site, and the robot needs to go to different areas for "garbage" distribution and processing according to the task requirements.。

			
Customer No.1	Customer No.2	Customer No.3	Customer No.4

For each target customer area:

a) The recyclable waste disposal bins are placed on the left and the biohazard waste.

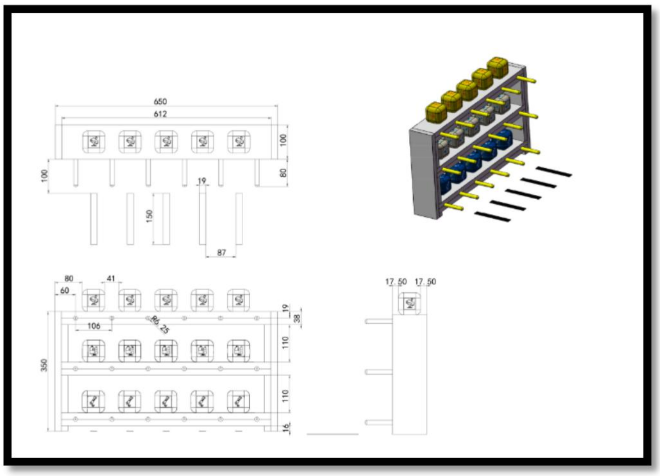
b) Each bin has a 150 mm long, 19 mm wide black tape line leading to the center of the bin.

c) Use the same 60 x 60 x 80 mm pink and green waste disposal bins.

d) The " Garbage " material must be placed above the " Garbage " disposal box and not fall out.

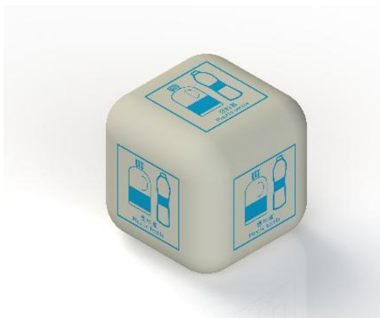
″ Garbage ″ distribution cabinet:

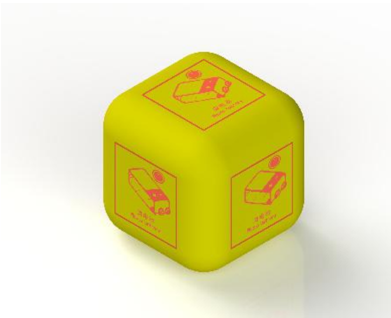
The " Garbage " distribution cabinet has three levels and holds three types of " Garbage " materials



″Garbage″ materials:

In the simulated waste separation environment, the mobile robot needs to manage three types of "waste" materials interactively. Among them:

<table>
<tr><td></td><td></td></tr>
<tr><td>Paper Materials</td><td>Plastic bottle Materials</td></tr>
<tr><td colspan="2">There are two types of recyclable garbage (Paper Materials and Plastic bottle Materials) 65mm x 65mm x 65mm "garbage" cubes. There is no limit to the number of " garbage " cubes that the robot can have at the same time for distribution management.</td></tr>
</table>

 Waste battery Materials	a) The biohazardous waste is a waste battery material, 65mm x 65mm x 65mm cube. b) The robot cannot have any more (paper material/plastic bottle material) drug cubes at the same time when it has a waste battery material cube. c) After the robot has finished handling the waste battery material cube, it must return to the cleaning area and complete the specified cleaning action (e.g., rotate 180°) on a 650mm diameter cleaning pad before handling the remaining "waste" cube.

″Garbage″ disposal bins:

Recyclable disposal bins	Biohazard disposal bins
a) Paper materials - Recyclable disposal bins b) Plastic bottle materials - Recyclable disposal bins c) Waste battery materials - Biohazard disposal bins	

Common Considerations:

Whether as a single module or as a series of separate or linked modules, test items measure the application of the knowledge, skills and behaviors defined in the standards (Skill Specification).

Combined with a scoring scheme, test items are designed to provide a comprehensive, balanced and realistic opportunity to assess and score against the standards. The relationship between the test items and the scoring scheme and the standards will be a key indicator of quality, as will the relationship between the standards and actual performance.

Test items do not include aspects outside of the standards and do not affect the balance of scoring within the standards.

The test items assess knowledge and understanding only through their application in actual work.

Competition Project Mission Statement

Competition content	Rating Content	Scoring Requirements
Module A: Work Organization and Management	Cooperative behavior with teammates, opponents and experts	Maintain courtesy between players and their teammates, opponents and supervising judges
	Site conditions	Workplace order for players / Placement of tools and accessories / Work area order

	Plan Implementation	Players must complete the tasks and accept supervision strictly in accordance with the requirements of the competition schedule at the specified time and place
Module B: Robot Assembly and Maintenance	Robot assembly and maintenance	Complete the commissioning of the robot within the time limit and do not damage the robot during the competition
Module C: Programming, Testing and Tuning	Known conditions under which the robot completes the specified task	Complete scheduled movements as required
	Known conditions under which the robot completes intermittent tasks	
	Robots perform intermittent tasks under unknown conditions	
	The robot completes autonomous movement in a simulation environment	
Module D: Integrated Task Demonstration	Unknown Task Auto Test 1	Ability to load the user's garbage correctly onto the garbage truck Able to place garbage on the garbage truck to the designated location correctly After completing the tasks in order, move to the starting area autonomously, project the chassis in the starting area, and turn off the switch of the robot indicator Total task completion including time spent
	Unknown Task Auto Test 2	

Module A: Work Organization and Management

The work organization and management aspect mainly assesses the basic quality of the contestants, including the management of the team work space during the contest participation, punctuality in the work process, cooperation and communication of the contestants in the venue, cooperation with other contestants when sharing the venue, and the performance of the contestants in the communication process with the judges.

Serial number	Judging Rules
A	The act of cooperation with teammates, opponents and experts on game day.
	The condition of the team field on race day.
	Race day plan execution.

Module B: Robot Assembly and Maintenance

Robot assembly and maintenance mainly assesses the contestants' ability of assembly, testing, maintenance, as well as troubleshooting and trouble-shooting; the contestants need to complete the assembly, testing, debugging and recovery of the robot within the specified time, and if the equipment breaks down, they can maintain and solve the trouble problems in time. During the competition, the equipment is guaranteed to operate normally.

Serial number	Judging Rules
B1	Complete robot setup, inspection and maintenance within the specified time frame
B2	Solve problems with the robot during commissioning in a timely manner

Module C: Programming, Testing and Tuning

The basic task tests were conducted in a known site layout. Three groups of "customers" and "garbage" were drawn and announced in the morning.

Before the programming starts, C2 draws a group of "customers" and "garbage" from the possible orders, and C3, after the robot program is downloaded, one player draws a group of "customers" and "garbage" from the rest. After the robot program has been downloaded, one player selects a group from the remaining "customer" and "garbage" groups, and another player starts the robot according to the instructions.

(Note: Each item is scored as completed or incomplete, not partially completed).

Serial number	Content	Judging Rules
C1	Known conditions under which the robot completes the specified task	Clockwise and counterclockwise rotation of the drive motor is controlled via front panel buttons
		The robot moves 100cm in a straight line in the designated starting area with a tolerance of ±10cm
		Controllable rotation speed of the motor is demonstrated through the front panel
		Robot rotates 90° clockwise, error ±10°
		The robot moves 100cm horizontally in the designated starting area with an error of ±10cm.
		Demonstration of robot reading ultrasonic sensor data
		Demonstration of robot reading infrared range sensor data
C2	Known conditions under which the robot completes intermittent tasks	Can automatically reach the front of the garbage can at the designated user location
		Can automatically grab the designated garbage can
		Automatic loading of garbage in designated bins
		Automatically places garbage in designated recycling stations
		Can move to the starting area independently, the chassis is projected in the starting area, and the switch of the robot indicator is turned off
C3	Robots perform intermittent tasks under unknown conditions	Can automatically reach the front of the garbage can at the designated user location
		Can automatically grab the designated garbage can
		Automatic loading of garbage in designated bins
		Automatically places garbage in designated recycling stations
		Can move to the starting area independently, the chassis is projected in the starting area, and the switch of the robot indicator is turned off
C4	The robot completes autonomous movement in a simulation environment	Correctly load the "garbage" of " plastic bottle "
		Correctly deliver the "garbage" of "plastic bottles" to the appropriate customers.
		Correctly load the "garbage" of "waste batteries".
		Correctly deliver the "garbage" of " waste battery " to the appropriate customer.
		Correctly load the "garbage" of "paper".
		Correctly deliver the "garbage" of " paper" to the appropriate customer.
		Return to the starting area
		Properly fill the "garbage" of the "plastic bottle".

		Correctly deliver the "garbage" of "plastic bottles" to the respective customers.

Module D: Integrated Task Demonstration

The comprehensive function test is to evaluate the robot's comprehensive control ability and its ability to adapt to the site and test environment in a short period of time. The judging team will judge the results by the robot's performance. Module D is the unknown automatic integrated function test, in which two "customers" and two "garbage" are selected and announced in the morning. D1 and D2 will be performed on an unknown field layout, which will be announced on the morning of the competition.

In order to achieve waste separation, the robot can only collect a single type of waste from a single customer at a time during the integrated task test.

Unknown Automatic Integrated Function Test case, after the robot has downloaded the program, the player may not touch the robot or the computer except to start the robot running, and the robot needs to complete the assigned task in full autonomy.

Automatic integrated function test for unknown conditions, specifying the order in which the "customer's" "garbage" is to be delivered to the recycling station, the robot needs to deliver the correct load of "garbage" to the corresponding recycling station in order. The robot needs to transport the correctly loaded "garbage" to the corresponding recycling station in order, and then return to the parts department to turn off the indicator light to complete the task. The robot needs to scan the marker and code to get the information of the "customer" and the type of "garbage" to be loaded. The order of delivery will not be announced to the contestants until they have downloaded the program and started the robot.

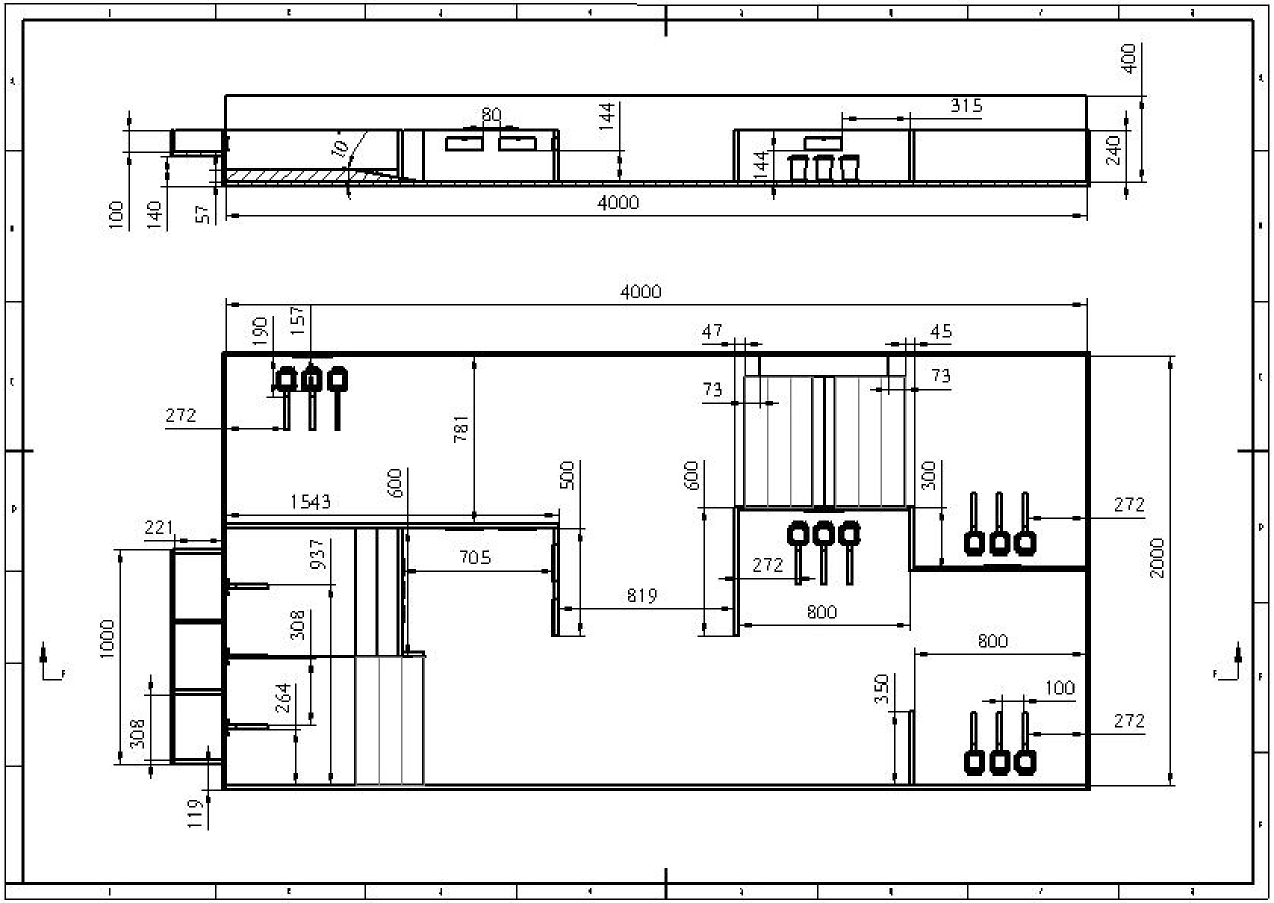
The robot completes tasks in sequence by scanning the code and recognizing the garbage icon.

Automatic integrated function test score sheet

Serial number	Content	Judging Rules
D1	Autonomous	Load the "garbage" of "Task 1" correctly.

	continuity task completion evaluation under unknown conditions1	Correctly transport the "garbage" from "Task 1" to the designated recycling station.
		Load the "garbage" of "Task 2" correctly.
		Correctly transport the "garbage" from "Task 2" to the designated recycling station.
		Load the "garbage" of "Task 3" correctly.
		Correctly transport the "garbage" from "Task 3" to the designated recycling station.
		Load the "garbage" of "Task 4" correctly.
		Correctly transport the "garbage" from "Task 4" to the designated recycling station.
		After completing the task in order, move to the starting area autonomously, project the chassis in the starting area, and turn off the switch of the robot indicator
		Task completion includes the total time spent.
D2	Autonomous continuity task completion evaluation under unknown conditions2	Load the "garbage" of "Task 1" correctly.
		Correctly transport the "garbage" from "Task 1" to the designated recycling station.
		Load the "garbage" of "Task 2" correctly.
		Correctly transport the "garbage" from "Task 2" to the designated recycling station.
		Load the "garbage" of "Task 3" correctly.
		Correctly transport the "garbage" from "Task 3" to the designated recycling station.
		Load the "garbage" of "Task 4" correctly.
		Correctly transport the "garbage" from "Task 4" to the designated recycling station.
		After completing the tasks in order, move to the starting area autonomously, project the chassis in the starting area, and turn off the switch of the robot indicator
		Task completion includes the total time spent.

Appendix I: Known sites



Appendix II: Task Library

Serial number	Clients				Garbage		
1	1 Acorn Court	2 Acorn Court	5 Maple Lane		Waste Material	Recycle Material	
2	1 Acorn Court	2 Acorn Court	5 Maple Lane		Waste Material		Biohazard Material
3	1 Acorn Court	2 Acorn Court	5 Maple Lane			Recycle Material	Biohazard Material
4	1 Acorn Court	2 Acorn Court		7 Bridge Road	Waste Material	Recycle Material	
5	1 Acorn Court	2 Acorn Court		7 Bridge Road	Waste Material		Biohazard Material
6	1 Acorn Court	2 Acorn Court		7 Bridge Road		Recycle Material	Biohazard Material
7		2 Acorn Court	5 Maple Lane	7 Bridge Road	Waste Material	Recycle Material	
8		2 Acorn Court	5 Maple Lane	7 Bridge Road	Waste Material		Biohazard Material
9		2 Acorn Court	5 Maple Lane	7 Bridge Road		Recycle Material	Biohazard Material