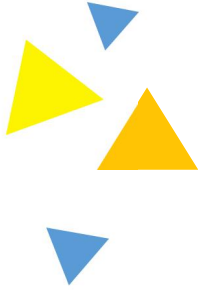




BRICS
2022 CHINA



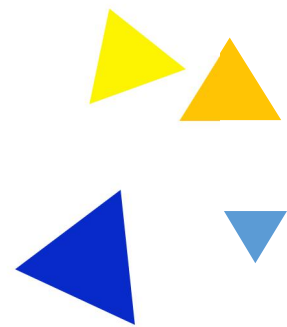
Sample topics of Competition

(offline finals)

BRICS-FS-18_Intelligent Service

Robotics

2022 BRICS SKILLS COMPETITION



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1. Form of competition

Single event (1 person).

2. Competition content

The competition consists of five modules. Provide participants with task descriptions, as well as data sources or other technical basic conditions required to ensure the independence and fairness of each task module. The competition content includes the following task modules based on the application development of the intelligent service robotics platform:

Module A: Assembly, adjustment and integration of intelligent service robotics modules

Module B: Safety and epidemic prevention application of intelligent service robotics

Module C: Comprehensive application of intelligent service robotics human-computer interaction

Module D: Integrated simulation application of intelligent service robotics

Module E: Safe production and occupational norms

Only when the competition site cannot be completed and approved by the chief expert can the competition tasks and scoring standards be changed.

If competitors do not comply with the requirements of occupational health, safety and environment, or put themselves and other competitors at risk, they may be disqualified.

After completing the module task, the participants will score the results.

3. Project modules and time requirements

3.1 Project modules and time requirements

The intelligent service robotics - medical epidemic prevention application event has five modules in total, and the contestants are required to complete it within 180 minutes. Refer to Table 1 for specific project module names and time requirements.

Table 1 List of Project Modules and Time Requirements

Number	Module Name	Completion time of competition content
1	Assembly, adjustment and integration of intelligent service robotics modules	90 min
2	Module B: Safety and epidemic prevention application of intelligent service robotics	

3	Module C: Comprehensive application of intelligent service robotics human-computer interaction	90 min
4	Module D: Integrated simulation application of intelligent service robotics	
5	Module E: Safe production and occupational norms	The whole competition

3.2 Task scenario introduction

Nowadays, with the COVID-19 pandemic, the medical systems of all countries in the world are under unprecedented pressure. Under such a big environment, intelligent service robotics are playing an increasingly important role in supporting medical personnel in the hospital environment.

In this competition, relying on intelligent detection and sensor technology, intelligent control technology, human-computer interaction technology, autonomous navigation technology, autonomous path planning and other technologies, using intelligent service robotics as carriers, realize the application scenarios of intelligent service robotics in the hospital environment for health inspection, safety epidemic prevention and disinfection, and intelligent drug dispensing and recovery

Please complete the work in modules A, B, C, D and E within the specified time, with a total time of 180min.

3.3 Introduction to competition platform

1. Composition of competition platform

The main configuration list of the competition platform is shown in the table below, but not limited to this table.

Table 2 Main Configuration List of Technical Platform

Number	Service Name	Quantity	Unit
1	Intelligent Service Robotics	1	Piece
2	Epidemic prevention and disinfection and sterilization module	1	Set

3	Health security module	1	Set
5	Intelligent IoT module	1	Set
6	Intelligent desktop mechanical arm	1	Piece
7	Intelligent programming device	1	Piece

2. Description of competition platform

(1) Intelligent programming device: as shown in Figure 1, it is composed of training host and used for data annotation and data set production, which can realize training and verification of mask recognition model.



Fig. 1 Operation console and display

(2) Universal intelligent service robotics: as shown in Figure 2, it is composed of Z-shaped display bracket, display and Castle-X chassis.



Fig. 2 Universal intelligent service robotics

(3) Intelligent mechanical arm module: as shown in Figure 3, it is composed of a mechanical arm, an intelligent 2D camera and an automatic suction cup, and is used for grasping and placing drugs.



Fig. 3 Intelligent mechanical arm module

(4) UV disinfection and sterilization module: as shown in Figure 4, it is composed of UV lamp and UV disinfection and sterilization equipment, which is used to realize the UV disinfection and sterilization function.



Fig. 4 UV disinfection and sterilization module

(5) Health and security inspection module: as shown in Fig. 5, it is composed of microphone module, security module (including 2D camera and temperature measurement module), display and connecting rod equipment, which is used to realize ultraviolet disinfection and sterilization function.

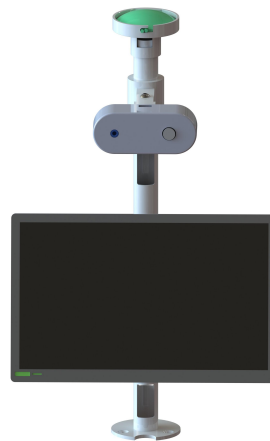


Fig. 5 Health and security inspection module

(6) Medical application site: as shown in Figure 6, it is divided into robotics starting point, hospital hall, hospital entrance, disinfection and sterilization room, treatment room, pharmacy, ward and treatment room. The environment of different hospitals will be different. The intelligent service robotics needs to be suitable for various hospital layouts. At present, the venue is a kind of venue layout for reference. The dimension drawing is shown in Attachment 1. The specific layout and dimension drawing will be published in the competition assignment.

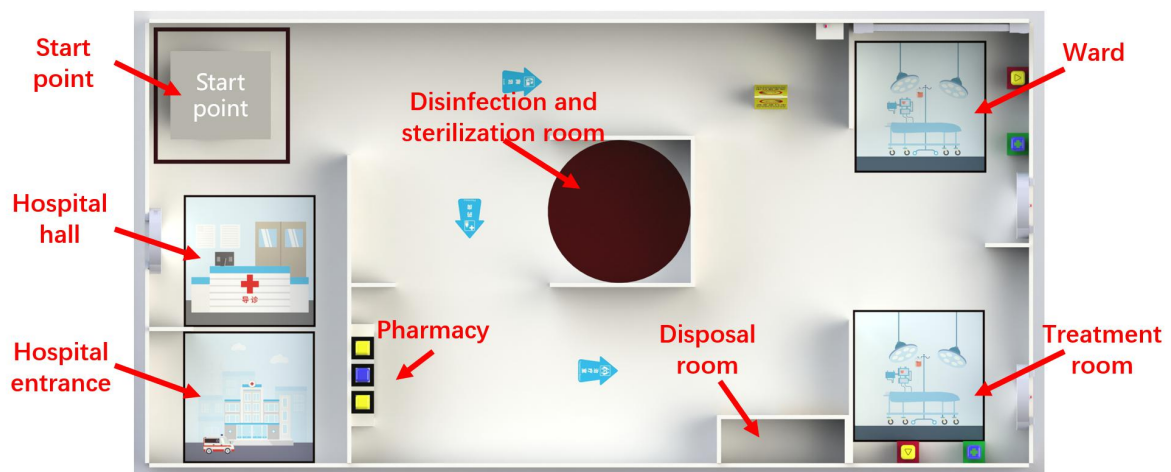


Fig. 6 Medical application site

Including:

Start point: The 600×600mm at the upper left corner square area is the starting point area of the intelligent service robotics. When and only when the intelligent service robotics is

completely within the black box area under projection and does not exceed the black line, it can be considered that the intelligent service robotics is in the starting point area.

Hall: a 600x600mm square area located in the middle of the left side. When and only when the intelligent service robotics is completely within the black box area of the hall under projection and does not exceed the black line, it can be considered that the intelligent service robotics is located in the hall area. An IoT lamp is placed in it.

Door: A 600×600 mm at the lower left corner square area can be regarded as an intelligent service robotics in the doorway area only when it is completely within the black box area of the doorway and does not exceed the black line under projection.

Disinfection and sterilization room: a circular area with a diameter of 650mm located in the middle. During the operation of the robotics in the disinfection and sterilization room, it should always keep its body in this circular area.

Disposal room: 600×200mm area at the lower right for drug disposal.

Pharmacy: located on the right side of the hospital entrance, a pharmacy area is equipped with a medicine cabinet with the size shown in Figure 7. There are three medicine boxes to be distributed on the medicine cabinet, and the order and quantity of medicine placement are announced.

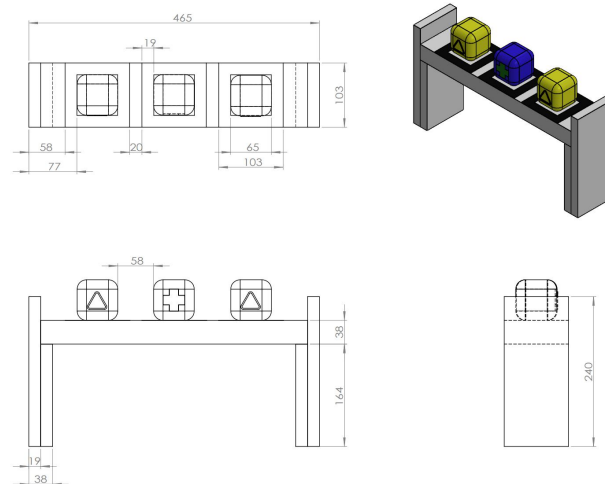


Fig. 7 Definition of medicine cabinet

Ward: A 600×600mm square area in the upper right corner can be regarded as an intelligent service robotics located in the ward area only when it is completely within the black box area of the ward under projection and does not exceed the black line. There is an IoT light and curtain.

Treatment room: The 600×600mm square area in the lower right corner can be regarded as the intelligent service robotics is located in the treatment room area only when the intelligent service robotics is completely within the black box area of the treatment room

under projection and does not exceed the black line. An IoT lamp is placed in it.

Notice board: As shown in Figure 8, the size is 195×110×295mm, it's placement position is announced by the competition task book.



Fig. 8 Billboard

3.4 Task content

Module A: Assembly, adjustment and integration of intelligent service robotics modules

The assessment focuses on the integration and debugging of mechanical, electronic and electrical, software systems and other modules, as well as the model training, model deployment, map construction, autonomous obstacle avoidance, path planning, mask recognition and epidemic prevention and temperature measurement application scenarios of the intelligent service robotics. Contestants shall complete the designated task within the specified time according to the task requirements.

Task A1: Data annotation and model training

The participating teams complete image cleaning based on the mask material library provided, complete the production of data sets through the annotation software provided, and train a model that can detect unknown images with high accuracy based on the produced image data set with the help of depth learning related tool software to complete model training and model verification tasks.

Task requirements:

- 1) Collect and select appropriate picture materials based on the provided material library;
- 2) Based on the collected photos and the specific label requirements of each category, the annotation is completed and made into a data set in a specific format;
- 3) Preprocess the data set to produce training set and verification set;
- 4) Configure training environment, complete model training through parameter optimization and network reconstruction;
- 5) Based on the trained model and the materials provided, verify the accuracy of model identification.

Task A2: Module installation and commissioning

Check the working environment and equipment, and complete the installation and commissioning of the health and security inspection module of the intelligent service robotics. It is necessary to use power lines and communication lines. Please ensure that the wiring is standard, clean and firm, and the interface connection is correct during the implementation of the task.

specific requirement:

- 1) Complete the installation and connection of the health and security inspection module of the intelligent intelligent service robotics, and ensure that the wiring is standard, clean and firm, and the interface connection is correct;
- 2) Complete the health and security inspection module debugging.

Task A3: Application of health security screening scenarios

Intelligently enable the intelligent service robotics, and realize the application of the health and security inspection scene of the intelligent service robotics in combination with the training model, voice interaction, path planning, intelligent detection and other functions deployed on the intelligent service robotics.

specific requirement:

- 1) Realize the application of health security inspection scene where the intelligent service robotics starts from the starting point, arrives at the hospital gate, and performs mask identification and temperature detection.

Module B Safety and epidemic prevention application of intelligent service robotics

Focusing on intelligent detection and network, Internet of Things module, medical security and epidemic prevention application, programming and debugging, contestants should complete the designated task within the specified time according to the task requirements.

Task B1: Installation and commissioning of epidemic prevention and disinfection module

Check the working environment and equipment, and complete the installation and commissioning of the UV disinfection and sterilization module of the intelligent service robotics. It is necessary to use power lines and communication lines. Please ensure that the wiring is standard, clean and firm, and the interface connection is correct during the implementation of the task.

Task requirements:

- 1) Complete the installation and commissioning of the UV disinfection and sterilization module, ensure that the wiring is standard, clean and firm, and the interface connection is correct;
- 2) Complete the debugging of UV disinfection and sterilization module.

Task B2: Installation and commissioning of IoT module

According to the task requirements, complete the programming and debugging of the IoT module, configure each IoT module network, achieve normal communication between modules, and control each IoT module through the intelligent service robotics.

Task requirements:

- 1) Complete the programming and debugging of the IoT module in the site;
- 2) Configure the network settings of various IoT modules to achieve normal communication between modules;
- 3) Control various IoT modules through intelligent service robotics.

Task B3: Map building and autonomous navigation

According to the task requirements, write and debug the intelligent service robotics program, combine the scene and intelligent service robotics map construction, autonomous obstacle avoidance, path planning, and complete the autonomous navigation of the intelligent service robotics scene.

Task requirements:

- 1) It is required to start the navigation of the intelligent service robotics, control the movement of the intelligent service robotics in the field, and construct the map;
- 2) Record the coordinate data of the navigation point to realize the autonomous cruise of the intelligent service robotics at the navigation point.

Task B4: Comprehensive application of epidemic prevention and disinfection

Intelligently enable the intelligent service robotics, complete the map construction, autonomous obstacle avoidance and path planning of the intelligent service robotics, and

control the robotics to complete the scene application of autonomous disinfection.

Task requirements:

- 1) Complete the construction of the intelligent service robotics epidemic prevention and disinfection scene map;
- 2) Based on the constructed epidemic prevention and disinfection scene map, set disinfection navigation points according to the position specified by the task;
- 3) Compile the comprehensive application program of epidemic prevention and disinfection, and start the epidemic prevention and disinfection operation of the intelligent service robotics in combination with the Internet of Things module;
- 4) During the disinfection process, the intelligent service robotics cruises independently according to the target point required by the task, and lights up the Internet of Things when it reaches the designated navigation point.

Module C Comprehensive application of intelligent service robotics human-computer interaction

Focusing on the intelligent service robotics in the human-computer interaction scene, including visual identification, drug resource distribution, distribution, recycling scene application, programming and debugging, the contestants should complete the designated task within the specified time according to the task requirements.

Task C1: Installation and commissioning of intelligent mechanical arm

Check the working environment and equipment, and complete the installation and commissioning of the intelligent mechanical arm module of the intelligent service robotics. It is necessary to use power lines and communication lines. Please ensure that the wiring is standard, clean and firm, and the interface connection is correct during the implementation of the task.

Task requirements:

- 1) Complete the installation and commissioning of the intelligent mechanical arm module, and ensure that the wiring is standard, clean and firm, and the interface connection is correct;
- 2) Complete the installation and debugging of the intelligent mechanical arm, and realize the motion control of the mechanical arm by the intelligent service robotics.

Task C2: Intelligent capture and placement

Complete the programming and debugging of the intelligent mechanical arm and the visual recognition module, and realize the grasping and placing of drugs.

Task requirements:

- 1) Complete the adjustment of drug identification parameters;
- 2) Complete the capture of drugs and place them in the disposal room.

Task C3: Application of drug distribution, distribution and recovery scenarios

Intelligently enable the intelligent service robotics, compile and debug the intelligent service robotics program in combination with the scene and intelligent service robotics map construction, autonomous obstacle avoidance, path planning, visual recognition module, intelligent manipulator module, etc., and complete the scene application of intelligent service robotics drug distribution, distribution and recycling.

Task requirements:

- 1) Compile and debug the intelligent service robotics program to achieve the target drug specified by the robotics arm grasping task requirements;
- 2) Set the designated distribution area according to the scene map;
- 3) Compile and debug the intelligent service robotics program to enable the intelligent service robotics to identify and capture the designated target drugs, and complete the drug distribution, distribution and recycling in the designated area and manner required by the task in combination with autonomous navigation, autonomous obstacle avoidance, and path planning.

Module D Safe Production and Occupational Norms

Task D1: Intelligent simulation scenario application of intelligent service robotics

Build a simulation environment. In the simulation environment, call the corresponding module programs and simulate the sensors, and fuse the sensor data to complete the corresponding scene map construction. Set navigation points based on the map, and enable the robotics to complete corresponding tasks.

Task requirements:

- 1) According to the task requirements, start the simulation environment, add relevant objects in the provided medical 3D simulation scene, and complete the construction;
- 2) According to the task requirements, complete the construction of two-dimensional grid map of the simulation game scene through SLAM mapping, and save the map to the designated workspace;
- 3) According to the task requirements, intelligently enable the intelligent service robotics, and combined with the scene and intelligent service robotics map construction, autonomous obstacle avoidance, path planning, Internet of Things module, visual recognition module, etc.,

the intelligent service robotics program is compiled and debugged to complete the intelligent service robotics integrated scene application.

Module E Safe Production and Occupational Norms

The contestants shall abide by the safety production and professional norms throughout the competition, and the tasks include the following:

- 1) Strictly follow relevant professional quality requirements and safety specifications;
- 2) Civilized participation and maintaining safety awareness;
- 3) Professional specifications and complete archives to prevent personal injury caused by machinery and equipment;

4. Scoring criteria

Table 10 Scoring Criteria

Module	detailed rules and regulations	Score
A	<ol style="list-style-type: none"> 1. According to the task requirements, use the dataset creation software to complete the data collection, cleaning and labeling of the detection unit, create the dataset, and perform parameter tuning of the training model, complete model validation and model training; 2. To complete the installation and debugging of mechanical module, electrical and electronic module, software system module, network module and identity module according to the task requirements; and to test each module using the intelligent service robotics application development and testing tools; 3. Writing and debugging intelligent service robotics programs according to the task requirements, intelligently empowering the intelligent service robotics, and completing the application of map construction, autonomous obstacle avoidance, and path planning functions of the intelligent service robotics; 4. According to the task requirements, the scenario application of intelligent service robotics epidemic prevention realized by combining the deployment of trained models, voice interaction, autonomous navigation and intelligent detection on the intelligent service robotics. 	25.00
B	<ol style="list-style-type: none"> 1. Complete the programming and debugging of the intelligent non-contact epidemic prevention and disinfection module according to the task requirements, and realize the control of the intelligent non-contact epidemic prevention and disinfection module through the intelligent service robotics; 2. According to the task requirements, complete the programming and debugging of IoT modules, configure the network of each IoT module, achieve normal communication between modules, and control each IoT module through the intelligent service robotics; 3. According to the task requirements, write and debug the intelligent service robotics program, and combine with the IOT module to realize the scenario application of autonomous disinfection of the intelligent service robotics. 	25.00
C	<ol style="list-style-type: none"> 1. According to the task requirements, write and debug the intelligent service robotics program, combine the scene and intelligent service robotics map construction, autonomous obstacle avoidance and path planning, set different explanation content, 	30.00

	<p>and complete the scene autonomous explanation task;</p> <p>2. To complete the programming and debugging of the robotic arm and the vision recognition module according to the task requirements and to realize the control of the robotic arm and the vision recognition module;</p> <p>3. According to the task requirements, intelligent enable the intelligent service robotics, combined with the scene and intelligent service robotics map construction, autonomous obstacle avoidance, path planning, IOT module, visual recognition module, etc., write and debug the intelligent service robotics program, complete the scene application of intelligent service robotics material distribution and delivery.</p>	
D	<p>1. Start the simulation environment according to the task requirements. In the built simulation environment, call the corresponding module program and simulated sensors, and fuse the sensor data to complete the construction of the corresponding scene map;</p> <p>2. Based on the constructed scenarios, set the corresponding navigation points and empower the robot to complete the corresponding tasks.</p>	15.00
E	<p>1. Strictly follow relevant professional quality requirements and safety specifications;</p> <p>2. Civilized participation and maintaining safety awareness;</p> <p>3. Professional specifications and complete archive data to prevent personal injury caused by machinery and equipment.</p>	5.00
Total		100.00

Attachment 1

