2024

BRICS SKILLS COMPETITION

(BRICS FUTURE SKILLS & TECHNOLOGY CHALLENGE)

Industrial Robot Digital Twin Technology Application

BRICS-FS-40

Technical Description_Online

(International Final)

July, 2024

Catalogue

1 Project profile

1.1 Item description

Event in industrial robot digital twin as the core, with 3C industry is the most typical alien chip plug-in process and rail rail welding grinding for the task of industrial robot palletizing, glue, assembly, welding, grinding process application, which covers the industrial robot system of virtual debugging, software and hardware installation and debugging, integration and application fields. To test the comprehensive professional qualities of team planning, organization and team cooperation, emphasize innovation ability and practical operation ability, and improve students' vocational ability and employment quality.

1.2 Competition purpose

To implement the chairman xi for skills work series of important instructions, better in the whole society to vigorously carry forward the spirit of labor model, labor spirit, spirit, encourage more workers, especially the young generation skills, skills, cultivate more skilled talents and big craftsmen, promote the development of employment entrepreneurship and high quality in China. At the same time, in order to continue to implement the spirit of the Xiamen Declaration, the Johannesburg Declaration, the Brasilia Declaration and the Moscow Declaration, and jointly promote the second golden decade of cooperation between the BRICS countries.

Competition aims to examine the contestants of industrial robot system installation, script programming, debugging, virtual simulation debugging and other professional ability and team quality, quality control, safety consciousness, both players in system integration product operational service technology application, at the same time with real industrial application scenarios as the carrier, fully test players in the face of complex task requirements problem analysis, processing and implementation ability, show the comprehensive professional quality

and skills application level.

2 Ability the need to have

(1) Basic knowledge that should be skillfully mastered.

1) Industrial robot technology knowledge

2) Mechanical installation and debugging knowledge

3) Electrical installation and debugging knowledge

4) Pneumatic control technical knowledge

5) Sensor technical knowledge

6) PLC control and application knowledge

7) Intelligent vision detection technology knowledge

8) Technical knowledge of HMI human unit state

9) Knowledge of structured programming and virtual simulation technology

10) Safety operation procedures, professional rules and knowledge

(2) Basic skills that should be mastered

1) Digital twin and virtual debugging software use skills, including virtual debugging methods

2) The use method of industrial robot system includes parameter setting, system calibration, typical program design, etc

3) Visual use methods, including communication Settings, typical programming, etc

4) The use method of PLC system, including input and output connection, communication method, typical program design, etc

5) Application of industrial network technology, including basic network architecture, networking methods, communication protocols, data acquisition and processing, etc

6) Installation, commissioning, maintenance and maintenance of general electromechanical equipment

3 Competition items

3.1 Competition module

The competition will be a group of 2 people, with a duration of 2.5 hours. The contestants will complete the task book independently, and get the average score according to the results of the two contestants.

module	assignment
module A	Virtual construction of integrated systems
	Definition of Mechanical and Electrical Behavior
	IO signal configuration and correlation
	Virtual programming and debugging of industrial robots
	Virtual debugging of integrated systems

3.2 Description of the competition

Module A Virtual debugging of industrial robot system

Module A-1 simulation environment construction (model scene construction, part definition, address matching and other work tasks in the virtual simulation software)

Manual debugging of Module A-2 integrated system (manual debugging of hardware button and virtual environment through PLC training box)

Module A-3 integrated system virtual debugging (by writing PLC and touch screen program, complete the industrial robot program simulation in the virtual simulation software, and finally complete the overall commissioning, complete the industrial robot palentizing, glue, assembly, multi-process processing and other tasks)

4. Competition methods

There is no competition group in this competition. The ages of 16 (born before January 1,2008) -35 (born after January 1,1989) in higher vocational colleges (including vocational and technical colleges), teachers and students, employees of enterprises and institutions can apply for the competition.

Each team is composed of players, guidance experts (instructors), translators and team support personnel (team leaders), among which the players and guidance experts are the necessary personnel. Each participating team is limited to 2 experts.

5. Competition process

Table 1 Competition workflow schedule

Competition day	time	item	participant	place
first day	8:00-8:30	Participants will enter the competition conference room	Teams and referees	Tencent Conference (tentative)
	8:30-8:40	Send out the competition title file compression package	Teams and referees	Tencent conference
	8:40-8:45	The computer opens the screen recording software	The team	Tencent conference
	8:45-9:00	Hair decompression code	The team	Tencent conferenc

				e
	9:00-11:30	Start the competition	Participating teams, referees and competition supervisors	Tencent conferenc e
	11:30-11:40	At the end of the competition, the contestants will record the scoring demonstration video as required	The team	Tencent conferenc e
	11:40-12:30	Submit the competition result document and record the screen	The team	postbox

6. Competition volume

The sample paper is consistent with the official competition paper in terms of the question type, the proportion of knowledge points and skill points covered, the proportion of free and creative content, and the change is not more than 30%.

7 Performance evaluation

7.1 Principles for setting scoring standards

Competition title and criteria by the BRICS Skills Competition executive committee experts, related enterprises and industry experts, colleges experts design, in line with the

principle of scientific rigorous, fairness, strong operability evaluation criteria, scoring methods and scoring rules, combining professional ability evaluation and professional quality evaluation principle, total score of 100 points.

7.2 Scoring method

1. The referee group is responsible for the evaluation of the event results, has a chief referee, and is fully responsible for the adjudication and management of the events.

2. The contestants shall operate according to the requirements of the assignment book. The contents to be confirmed by the referee must raise their hands to be confirmed by the referee, otherwise no points will be scored.

3. In accordance with the principle of "fairness, justice, openness, science, standardization, transparency and no objection", the judging team will evaluate the results according to the on-site records of the judges, the task book and scoring standards of the team players.

4. The scoring method is process scoring and result scoring. The results shall be evaluated according to the on-site records of the referee, the competition task book and scoring criteria of the team players. All scoring materials must be confirmed by the corresponding scoring referee, the player and the chief referee.

5. The chief referee is responsible for the grouping of the referees. The referee without the corresponding adjudication task shall not enter the contestant's station. The player shows the function described in the scoring item as instructed by the referee.

7.3 Detailed scoring rules

Competition score will adopt the method of combining qualitative and quantitative, objective and fair to the scores of the task, in order to ensure that the objectivity of the competition, for each set of competition questions, will customize scoring criteria, scoring

items as far as possible to every detail, reduce the proportion of subjective judgment, to ensure the objective and fair.

Table 2 Distribution table of competition modules

module	Scoring items	Score points	value
module A	Simulation environment construction (35 points)	1）The virtual environment is consistent with the real environment construction 2）Set the software initial state correctly	10
		1）Complete the status machine definition of the cylinder correctly 2）Correct completion of the sensor definition 3）Complete the indicator light definition correctly 4）Complete the signal address matching correctly 5）Establish communication correctly	25
	Integrated system virtual connection (65 points)	1) Use ing tools 2) The beginning point and the end point of the glue coating process 3) The horizontal and directional deviation of the coating track and the coating components 4) Requirements for glue track 5) Virtual combination of glue coating process	20
		1) Code (remove) stacking claw tool use 2) The starting point and end point of the code (disassembly) process 3) Location requirements of material code (unstacking) (such as deviation, gap, etc.)	20

		4) code (disassembly) stack shape requirements 5) code (disassembly) stack process virtual joint adjustment	
		1）Use of the sucker tool 2）Chip assembly process, the starting point, the end point 3）Trus requirements for chip pickup 4）Chip detection of PLC control 5）Chip assembly process virtual coupling adjustment	25

Note: The proportion of each indicator in the actual competition process may be fine-tuned.

8. Competition environment

8.1 Overall environmental requirements

project	name	Configuration / version requirements	remarks
Hardware preparation	computer	I5-7700 or above CPU, 16 or above memory, 2G or above independent graphics card, available storage hard disk greater than 100GB	The computer has a camera, can connect to the external network
	PLC module	Siemens 1200 series CPU,	Self-provided

		the model is not limited	PLC power supply
	HMI	The Siemens series or other models that can communicate with Siemens	Provide HMI power supply
	Network cable 2	Ensure the communication connection according to the actual needs	-
Software preparation	PQFactory	The latest version of the 2024 official website	-
	Botu software	V15/V16	-
	Tencent conference	Official website version	-
	EV screen recording	Official website version	-
	Text processing software	-	-

8.2 Requirements for competition stations

1. Arrange an appropriate competition environment by yourself, so to be quiet, independent and undisturbed;

2. Stable power supply supply;

3. Stable network environment;

4. Test the hardware and software well in advance.

9 Technology platform

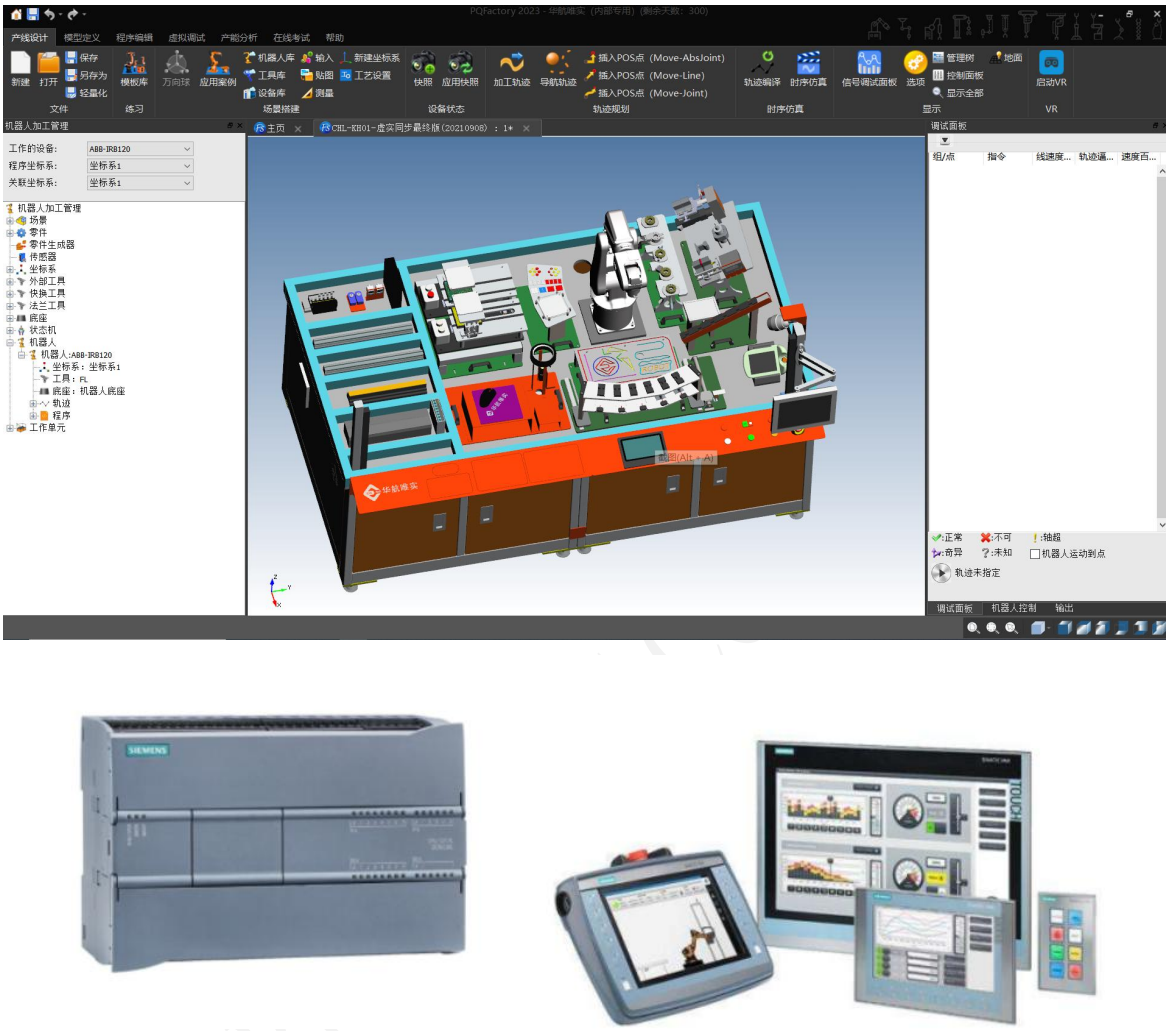

Figure 2 Schematic diagram of the competition platform

9.1 Technology Platform requirements

order number	name	Detailed technical parameters
1	computer	INTEL i5-8700 CPU (8 generation, 2.8GHz, 6 cores) or above; 8GB or above, 500GB hard disk capacity or above, Windows 10 operating system

2	PLC	(1) Built-in PROFINET; (2) high speed I / O capable of motion control, onboard analog input to minimize space requirements and additional I / O), 2 pulse generators for pulse width application and up to 6 high speed counters; (3) onboard I / O points in the CPU module provide 6 to 14 input points and 4 to 10 output points for DC, relay or analog I / O signal modules extending I / O points, innovative signal card on the front of the CPU to provide additional I / O.
3	HMI	Ideal entry-level product for simple HMI applications Integration with the engineering configuration of the TIA Portal Compatible installation with SIMATIC HMI smart panel and existing SIMATIC HMI trim panel 4 "and 6" models Flexible scalability within the range of HMI applications 64,000 colors, high resolution, adjustable brightness, widescreen display With new controls and graphics, an innovative user interface and better ease of use Touch control / button function, intuitive operation The interface supports multiple PLC connections Type PROFIBUS or type PROFINET By USB, the disk filing
4	Digital twin software	（1）You can freely define a variety of devices, including robots, cylinders, sensors, etc. The basic equipment of the production line can be defined independently, with virtual simulation without dead corners. Support PLC multiple signals, numerical types, Boolean type signals. With PLC instant communication, real analog equipment communication; （2） In the software, it can replace the real robot, cylinder,

		module, sensor, CNC machine tools and other production line equipment and PLC production line programming and debugging. Perfect simulation of actual device action and signaling. For the factory production line construction to save time and money costs. No real equipment can be purchased complete real PLC programming; 3) The bottom layer adopts OpenGL advanced display components for modular development to reduce the program interference dependence. The interface uses Microsoft Visual Studio and other mature tools, friendly human-computer interaction, simple and easy to use the operation. Realistic simulation design, efficient, fast and accurate simulation of equipment action. Is a simple operation of the powerful virtual debugging software.

10. Appeal and arbitration

10.1 Appeal and Arbitration

1. Establish an arbitration working group for the competitions. The arbitration working group shall work under the leadership of the organizing committee and shall be responsible for the organizing committee.

2. Responsibilities of the arbitrators

(1) Be familiar with the competition rules and rules.

(2) Master the progress of the competition.

(3) Accept the written appeal of each participating team.

(4) Conduct an in-depth investigation into the accepted complaints, and make an objective and fair collective arbitration.

10.2 Procedure of appeal and arbitration

1. Each participating team shall appeal to the arbitration working group against the instruments, equipment, tooling, materials, objects, computer hardware and software, competition tools, supplies, competition adjudication, competition management, competition results, and the non-standard behaviors of the staff that do not conform to the provisions of the competition rules.

2. The appeal subject is the guidance expert of the participating team.

3. When the complaint is initiated, the guiding expert shall submit a signed written appeal report to the arbitration working group. The report should give a full and realistic description of the phenomenon, the occurrence time, the personnel involved, and the basis of the complaint. Non-written appeal will not be accepted.

4. A complaint should be made within 2 hours of the end of the event. More than 2 hours is not accepted.

5. The competition arbitration working group shall organize the reconsideration within 2 hours after receiving the appeal report, and timely inform the complainant of the reconsideration result in writing. If the complainant party still has objections to the result of the reconsideration, the guiding expert may appeal to the arbitration committee of the competition area. The arbitration result of the division arbitration committee shall be final.

6. The complainant shall not refuse to accept the arbitration result for any reason; shall not take any reason to disturb the order of the competition; the arbitration result shall be signed by the complainant and shall not accepted; if the complainant leaves at the agreed time and place, it shall be deemed to have waived the appeal.

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