BRICS 2022 CHINA

2022 BRICS Skills Competition

(BRICS Future Skills Challenge)

TECHNICAL DESCRIPTION

Industrial Internet (Offline)

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1. Introduction

1.1 Name and description of the skills competition

1.1.1 The name of the skill competition

Industrial Internet

1.1.2 Skill Competition description

Industrial Internet is a new generation of information and communication technology and industrial economy deep integration of new infrastructure, application mode and industrial ecology, through the comprehensive connection of people, machines, things, systems, etc., to build a new manufacturing and service system covering the whole industry chain, full value chain. This competition closely follows the latest development trend of industrial Internet technology, focusing on core knowledge and skills such as edge layer equipment installation and maintenance and data acquisition, edge computing technology, device cloud technology, and equipment operation and maintenance data analysis.

Through the competition, the engineering practice ability and innovation ability of students in the application and development of industrial Internet technology are comprehensively tested; Strengthen students' understanding, mastery and application of relevant knowledge of industrial Internet technology; Cultivate students' hands-on ability, teamwork ability, sense of innovation and professionalism; Promote the combination of theory and practice, enhance the employment competitiveness of skilled talents, and improve the employment quality and employment level of students.

1.1.3 Competition system

The development of the industrial Internet establishment and application offline competition will be realized by the industrial Internet technology offline training and competition system as the carrier.

1.2 Relevance and importance of this document

This document contains the standards required for this skills competition, as well as information on the evaluation principles, methods and procedures for managing the competition.

Every expert and competitor must know and understand this technical note.

In the event of any conflict between the technical notes in different languages, the English version shall prevail.

2. Skill standards

2.1 General description of skill standards

Skills standards define knowledge, understanding and specific skills that are international best practices in technical and professional performance. It will reflect a global consensus on what the relevant job role or occupation represents in industry and business.

The skills competition is designed to reflect the international best practices described in the skills standard and the extent to which it can be achieved. Therefore, the standard is a guide to the training and preparation required for skills competitions.

The standard is divided into different sections with titles and reference numbers.

Each section is assigned a percentage of the total score to indicate its relative importance in the standard. This is often referred to as "weighting". The sum score of all percentages is 100. Weights determine the distribution of scores in the scoring criteria.

With a test item, the grading scheme evaluates only the skills listed in the criteria. They will reflect the criteria as comprehensively as possible within the constraints of the skills competition.

The scoring schema will be based on the scores assigned in the criteria to the actual possible extent. A 5% change is allowed, but the weight assigned by the standard specification cannot be changed.

2.2 Skill Standards

Standard specifications	
1	**Work organization and management**
	Should know and understand:
	1) Current health and safety regulations related to the industrial Internet industry
	2) Correct use and maintenance of personal safety protective equipment and clothing
	3) Recommended specifications and information published by product and equipment suppliers or manufacturers
	4) The process of maintaining and using professional equipment
	5) Industrial Internet related terms and symbols

	6) Terms and symbols related to communication technology
	Should be able to:
	1) Apply occupational health and safety regulations to the industrial Internet industry
	2) Correct use and maintenance of personal protective clothing and equipment
	3) Set, use, adjust and maintain all professional equipment
	4) Promote safe and healthy operations in the workplace
	5) Apply recommended specifications and information published by product and equipment suppliers or manufacturers
	6) Follow the manufacturer's safety technical manual
2	**Industrial Internet basic hardware**
	Should know and understand:
	The development trend of the industrial Internet
	The value point of the Industrial Internet
	The hardware composition of the Industrial Internet
	Application of programmable controllers in industrial Internet basic hardware
	Basic circuit knowledge of the basic hardware of the Industrial Internet
	The basic operating specifications of the basic hardware of the Industrial Internet
	Should be able to:
	Complete the construction of the basic hardware of the Industrial Internet
	Complete configuration in collaboration with PLC function
	Master the programmable controller Ethernet communication method
	Master applications that interact with data using Ethernet communication with configuration
	Proficiency in the use of comparison, calculation, and movement instructions
	Write logical instruction programs
	Master the basic control methods of motion control
3	**Industrial Internet architecture and industrial field data collection**
	Should know and understand:
	Industrial Internet architecture
	Industrial Internet technology system
	Industrial Internet standard system
	Should be able to:
	Master device communication protocols
	Complete the network deployment of industrial data acquisition equipment and the network connection of industrial equipment

	Complete the binding and configuration of the device and the gateway
	Complete verification of the accuracy of the collected data
	Identify gateway communication and data acquisition failures
4	**Industrial field data to the cloud**
	Should know and understand:
	Interbank communication protocol cognitive ability
	Structured language programming
	Cloud service configuration data configuration
	Identify the types of failures in cloud communication and data acquisition for industrial data
	Use ShippingDimension toolCheck the health status of the server operating system
	Should be able to:
	Master the gateway-to-cloud communication protocol
	Complete the mapping, binding, and configuration of industrial devices on the cloud platform
	Master the ability to configure data for cloud services
	Capable of scripting edge computing
	Verify the accuracy of data on the cloud platform
5	**Cloud platform and data analysis technology**
	Should know and understand:
	Use cloud computing technology
	Develop simple industrial interfaces
	Development of industrial Internet platform
	The value of big data in the industrial Internet
	Should be able to:
	Use industrial Internet big data to achieve data computing
	Complete the calculation of edge measurement data in industrial scenarios
	It has platform operation and maintenance capabilities
	Have the ability to build a platform

3. Grading schemes

3.1 Scoring Methods

Each scoring team scores the modules in their respective responsibilities, and the process score is combined with the post-event result scoring to score the artifacts completed on the same day. After the U disk data is stored, no one shall modify it, and it must be sealed and submitted to the referee for proper preservation. The evaluation scoring form and the measurement scoring table shall be signed and confirmed by each referee participating in the judging and submitted to the referee for safekeeping. The original scoring form is reviewed and signed by the referees of each group, and then confirmed by the referee leader and submitted to the staff entry system.

3.2 Scoring Rules

3.2.1 Evaluation and scoring based on the opinions of the judges (subjective assessment).

The judges' assessment is given on a scale of 0-3, with at least 3 experts participating. Each expert should make his own assessment, in which case the difference between the grades rated by the expert should not exceed 1 level. If level 1 is exceeded, the assessment is invalid and the expert should consult appropriately.

Each step of this assessment should be accompanied by a description of each assessment level: for example:

- 0 – performance below industry standards or absenteeism;
- 1 - Performance does not meet industry standards;
- 2 - Performance in line with industry standards;
- 3 – Performance completely exceeded industry standards and was rated as excellent.

Level 0 gets 0 points, level 1 gets 30% of the score, level 2 gets 60% of the score, and level 3 gets a perfect score.

3.2.2 Objective assessment and scoring

Each session is evaluated by three specialists. Unless otherwise noted, only the highest score or zero point is given. At the time of assessment, the reference points for some of the

scores are clearly defined in the link framework

The tournament is scored by task, with a maximum score of 100 points, and the detailed scoring requirements are shown in the table below.

Task	Proportion	Scoring requirements	Fractional specific gravity (cents)
Installation and wiring of the base unit	15%	The base unit is installed correctly	3
		Digital input wiring	3
		Analog input wiring	3
		Output signal wiring	3
		Communication signal wiring	3
PLC programming and debugging	20%	PLC program creation	1
		Manually operate program creation and debugging	2
		Origin recovery program creation and debugging	2
		Bot creation and debugging	8
		Create an alarm	2
		Establish monitoring point data	3
		Exception state handling	2
Touch screen display	10%	Complete the communication connection with the PLC	2
		Status data presentation	2
		Hand/Automatic status	2

		indication	
		The action control is complete with the input control	2
		Alarm display	2
Industrial networking and environmental monitoring	8%	Device networking	2
		The network configuration of the gateway	3
		Temperature and humidity data monitoring	3
Industrial energy consumption monitoring	6%	Power data acquisition	3
		Electrical energy data acquisition	3
Data edge processing	8%	Scripting feature writing	4
		Execution policy definitions and associations	2
		Writeback of the result of the calculation	2
Monitoring of production efficiency and product quality	6%	Collection of production process data	2
		Production quality data acquisition and calculation	4
Industrial visualization application design and construction	8%	Visual project data source creation	2
		Associative models and external data sources	2
		Visualize the design and publication of the page	4
Industrial data calculations	14%	Configure directives, rule expressions	6
		Write function	4

		expressions	
		Data is aggregated over time	4
On-site environment	5%	On-site environment	5

3.2.3 Ranking rules:

According to the ten modules of the grade. Rank by grade, if the scores are the same, compare the module A score, and the higher score will be ranked higher. If the total score of module A is the same, compare the score of module B, and the higher score will be ranked higher, and so on.

3.2.4 Spot Check Review:

In order to ensure the accuracy of the results statistics, the supervision team reviews the results of all the participating teams in the top 10 overall results; The remaining results shall be reviewed by sampling, and the coverage rate of sampling shall not be less than 15%. The supervision team will promptly inform the chief referee of the errors found in the re-inspection in writing, and the chief referee will correct the results and sign and confirm. If the error rate exceeds 5%, it will be regarded as a non-small probability event, and the referee team shall review all the results.

3.3 Basis for evaluation

In the design process, the selection of criteria and evaluation methods will be determined by scoring schemes and test items.

Evaluation based on, including but not limited to:

The completeness and specification of the work process

The completeness and specification of the job record card filling

The accuracy of parameter adjustment such as equipment action and equipment status

The result of troubleshooting

Personal protective situation

4. Test the project

4.1 Common Considerations

Whether it is a single module or a series of independent or associated modules, a test project can evaluate the application of the knowledge, skills, and behaviors defined in the standard (Skill Specification).

Combined with the scoring scheme, the purpose of the test project is to provide comprehensive, balanced and realistic opportunities for standard evaluation and scoring. The relationship between test items and scoring schemes and standards will be a key indicator of quality, just as the relationship between standards and actual job performance.

Test items do not include aspects other than the criteria and do not affect the balance of scoring within the criteria.

The test project's assessment of knowledge and understanding is carried out only through the application of it in practice.

4.2 Test the project format/framework

Module A: Installation and connection of the base unit

Module B: PLC programming and debugging

Module C: Touch screen display

Module D: Industrial Networking and Environmental Monitoring

Module E: Industrial energy consumption monitoring

Module F: Data edge processing reporting

Module G: Monitoring of production efficiency and product quality

Module H: Industrial Visualization Application Design and Construction

Module I: Industrial Data Calculations

Module J: Field Environment

4.3 Test project time allocation and score weight

Module		Duration	Score weight
Modul	Installation and	120	15
Modul	PLC programming	150	20
Modul	Touch screen display	60	10
Modul	Industrial networking	30	8
Modul	Industrial energy	30	6
Modul	Data edge processing	45	8
Modul	Monitoring of	45	6
Modul	Industrial	180	14
Modul	Industrial data	60	8
Modul	On-site environment		5
	total	720	100

4.4 The content and requirements of each module

The content of the competition covers network configuration, gateway configuration, data monitoring, cloud interface development, algorithm call writing, etc., and comprehensively examines the participants' industrial Internet integration and development capabilities.

Module A installation hands-on ability as the focus of the assessment; Module B PLC programming ability as the focus of assessment; Module C industrial configuration optimization as the focus of assessment; Module D industrial network as the focus of assessment; Module E data dynamic monitoring ability as the focus of assessment; Module F edge computing processing power is the focus of assessment; Module G platform data processing as the focus of assessment; Module H personality development as the focus of assessment; Module I algorithm development as the focus of assessment; Module J personal literacy is the focus of assessment;

Module	task	Scoring requirements
A	Installation and connection of the base unit	The base unit is installed correctly
		Digital input wiring
		Analog input wiring
		Output signal wiring

		Communication signal wiring
B	PLC programming and debugging	PLC program creation
		Manually operate program creation and debugging
		Origin recovery program creation and debugging
		Bot creation and debugging
		Create an alarm
		Establish monitoring point data
		Exception state handling
C	Touch screen display	Complete the communication connection with the PLC
		Status data presentation
		Hand/Automatic status indication
		The action control is complete with the input control
		Alarm display
D	Industrial networking and environmental monitoring	Device networking
		The network configuration of the gateway
		Temperature and humidity data monitoring
E	Industrial energy consumption monitoring	Power data acquisition
		Electrical energy data acquisition
F	Data edge processing	Scripting feature writing
		Execution policy definitions and

		associations
		Writeback of the result of the calculation
G	Monitoring of production efficiency and product quality	Collection of production process data
		Production quality data acquisition and calculation
H	Industrial visualization application design and construction	Visual project data source creation
		Associative models and external data sources
		Visualize the design and publication of the page
I	Industrial data calculations	Configure directives, rule expressions
		Write function expressions
		Data is aggregated over time
J	On-site environment	The scene is organized and orderly

5. Skills management and communication

5.1 Expert Group

The Skills Expert Group is composed of a chief skills expert and experts selected by each country, who are jointly responsible for further revising the technical documentation of the long-distance finals of this competition and the daily skills management.

5.2 Discussion Forum

Before the competition, regarding the preparation of software and hardware, the deployment of the examination environment and other related questions, the participants can give feedback through the industrial Internet network and the application competition platform mailbox or cloud conference. Training exchanges, pre-competition, competition and post-competition exchanges will also be carried out through the forum.

6. Security Requirements

Please refer to the health, safety and environmental policies and norms of the ORGANIZING Committee of the BRICS Vocational Skills Competition.

7. Materials and equipment

7.1 Infrastructure List

(1) Station hardware equipped with:

Number	name	quantity	remark
1	Structural framework	1 unit	The aluminum steel structure can be installed freely and flexibly as an installation carrier for mechanical and electrical equipment of automatic production lines.
2	Raw material library unit	1 set	It is mainly composed of vertical material barrel and electric pusher device. Automatic functions such as storage and discharge of workpieces can be completed.
3	Detection line unit	1 set	It is composed of a conveyor line, a drive motor, a detection sensor, etc., to realize the process flow of transmission and detection of workpieces on the assembly line.
4	Sorting unit	1 set	Implement workpiece sorting action.
5	Industrial network unit	1 set	It is composed of industrial gateways, switches, hubs, etc., to achieve industrial network construction, OT and IT data fusion.
6	Industrial Environment Unit	1 set	It is composed of a variety of industrial environment sensors, including temperature and humidity and air quality, to achieve real-time collection of environmental data.

Number	name	quantity	remark
7	Carbon neutral collection unit	1 set	The combination of electric energy collection sensing and carbon dioxide sensing is used to realize the online detection application of energy consumption.
8	Service safety unit	1 set	It consists of smoke sensing and vibration sensing, etc., and shows real-time monitoring of safe production conditions.

(2) Site hardware equipment

hardware	quantity	Specific configuration	remark
Banner or large screen	1	CCVR2021 *** Sub-Arena" (full name of the school).	
Spare accessories	Several	Computers, cameras, USB sticks, etc	Damaged hardware at the site can be replaced at any time
monitor	1	Mobile phone or video recorder	The entire game was recorded
Computer or mobile phone	1	Zoom meetings	Used to liaise with the main arena

(3) Computer software configuration:

Software	Specific configuration
operating system	Windows operating system
Support frame	. NetFarmWork4.5.2
Unzip the software	For example: 7ZIP
Office software	For example: Microsoft Office
Web browser	Google Chrome

PLC programming software	CX-ProgrammaV9.75/TIAPortal/XDPPro V3.7.14b (selected by actual PLC).
Human-machine interface and gateway	Software Fstudio 2.0, FlexManager, McgsPro
Develop software	.net development software, Java development software, Python development software, etc., support web design, interface calls, background logic algorithm writing and other development software
Competition software	Industrial Internet underlying platform, industrial Internet cloud platform

(4) Network configuration:

project	Specific configuration
Network configuration	Workstation computers support Internet connection, bandwidth greater than 4M

7.2 Proposed site and workstation layout

7.2.1 Examination placement requirements

(1) The competition venue is well-lit and well-lit; The power supply and water supply facilities are normal and safe; The grounds are tidy.

(2) The competition venue shall be divided with a barrier, and non-referees, Competitors and staff shall not enter the competition venue.

(3) The stadium is equipped with security, fire protection, medical treatment, equipment maintenance standby to prevent emergencies.

(4) The venue sets up safe passages and cordons to ensure that the personnel who enter the arena for visiting, interviewing and inspecting the competition are limited to the safe area to ensure the safe and orderly progress of the competition.

7.2.2 Layout requirements for mobile monitoring equipment

The centerline of the mobile monitoring device 1 is required to be at a 45° angle with the plane of the competition operation display, which can monitor the competition operation display and the side face of the Competitionant, and the monitoring distance can be monitored

to the vicinity of the examination position within 1 meter, and the height is about 1.5 meters.

The mobile monitoring device 2 is placed on the examination table, and its centerline requires that the plane of the competition operation display be at an angle of about 45 °, which requires that it can maximize the presentation of a complete display competition screen (the display competition screen is filled with mobile monitoring equipment as much as possible).