2025

BRICS SKILLS COMPETITION
(BRICS+ FUTURE SKILLS & TECH CHALLENGE)

Internet of Things
BRICS-FS-16

Technical Description
(International Final_Offline)

Jun, 2025

Contents

1. Introduction

1.1 Name and Description of the Skill Competition

1.1.1 Skill Competition Name

Competition Name：Internet of Things

Competition Number：BRICS-FS-16

1.1.2 Skill Competition Description

The offline competition of the 2025 BRICS Skills Competition (BRICS Future Skills and Technology Challenge) - Internet of Things event is a platform built on the Internet of Things competition platform, consisting of the Internet of Things cloud platform, the Internet of Things competition platform, the AOT platform system and other parts. Contestants need to complete relevant assignment assessments offline through computers and tools. The Internet of Things event is a team skills competition, with each team consisting of two contestants.

The skills assessed include several aspects: IoT equipment selection and engineering design capabilities, IoT software and hardware installation and debugging capabilities, IoT system integration and construction capabilities, IoT platform configuration management capabilities, IoT application development and debugging capabilities, and professional qualities.

1.2 Relevance and importance of this document

This document contains the criteria required for this skills competition, as well as

information on the evaluation principles, methods and procedures governing the competition.

Every expert and player must know and understand this technical description.

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

2 Skill Standards

2.1 General description of skill standards

Skills standards set out the knowledgeand specific skills that are international best practice in technical and occupational performance. It will reflect a global consensus on what the relevant job role or occupation represents in industry and business.

Skills competitions are designed to reflect international best practice as described in this skills standard, and to the extent it can be achieved. As such, the standard is a guide to the training and preparation required for skills competitions.

The criterion is divided into different sections. Each section is assigned a percentage of the total score to indicate its relative importance within the criterion. This is often referred to as the "weight". The sum of all percentages adds up to 100. The weight determines how the score is allocated within the criterion.

The competition content will only assess the skills listed in the standards, reflecting the standards as comprehensively as possible.

Marking schemes will be evaluated according to the points allocated in the standard to the extent practicable, with a 5% variation allowed, but the weights assigned by the standard specification shall not be changed.

2.2 Skill Standards

Skill Standards		Proportion(%)
1	**Work organization and management**	**2**
Basic Requirements	● Technical specifications and terminology related to safe production operations, as well as special requirements for specific positions ● Basic knowledge of lean production Honesty and integrity ● Self-motivation, teamwork problem solving, self-protection, effective work under pressure ● Best practice in relation to health and safety regulations, obligations and documentation and skills ● Principles of safe use of electricity	
Skills	● Work professionally in the relevant environment and other factors ● Collaborate with colleagues and teams in local and remote environments ● Present ideas to the team or clients and respond to client needs ● Take care of yourself and others' safety in the workplace ● Take appropriate preventive measures to minimize accidents and impacts ● Use process records that meet international standards to provide traceability for development and revision ● Interpret and recognize international symbols, diagrams and other international languages used by standards bodies ● Assist engineers in preparing reports and records on test techniques, laboratory equipment and procedures ● Communicate effectively with customers ● Train others to use facilities and equipment ● Professional performance at the client's premises ● Enable documented process maintenance policy	
2	**IoT Engineering Design and Implementation**	**55**

Basic Requirements	● Common professional tool usage and skills Common testing instrument operation and measurement methods Application of electrical and debugging tools ● Build and debug wired and wireless network environments; IoT terminal equipment circuit working principles; troubleshooting, testing and maintenance environment conditions ● Knowledge of limitations and usage of testing equipment and tools ● Preventive judgment of application scenarios and inspection and measurement technology of unreliable terminal equipment for maintenance of electrical equipment ● Cloud platform system software technology network environment construction, configuration and connection ● Modbus RTU/Modbus TCP standard communication protocol data collection display method	
Skills	● Select network cables and use tools to make network cable jumpers ● Correctly select routers and be able to build and configure wired and wireless network environments ● Correctly add, manage IoT devices and set parameters ● Be able to correctly configure and use serial port debugging tool software ● Can realize real-time data display and scene linkage ● Ability to read software and hardware manuals ● Determine the cause of the operation error and the measures to be taken ● Use professional tools and testing instruments to detect, debug and replace defective and malfunctioning terminals and application modules	
3	**IoT Engineering Maintenance and Optimization**	**20**
Basic Requirements	● Common professional tool usage and skills Common testing instrument operation and	

	measurement methods Application of electrical and debugging tools ● Build and debug wired and wireless network environments; IoT terminal equipment circuit working principles; troubleshooting, testing and maintenance environment conditions ● Knowledge of limitations and usage of testing equipment and tools ● Preventive judgment of application scenarios and inspection and measurement technology of unreliable terminal equipment for maintenance of electrical equipment ● Cloud platform system, terminal troubleshooting software technology network environment construction, configuration and connection ● Modbus RTU/Modbus TCP standard communication protocol data collection display method	
Skills	● Select network cables and use tools to make network cable jumpers ● Correctly select routers and be able to build and configure wired and wireless network environments ● Correctly add, manage IoT devices and set parameters ● Be able to correctly configure and use serial port debugging tool software ● Can realize real-time data display and scene linkage ● Ability to read software and hardware manuals ● Determine the cause of the operation error and the measures to be taken ● Use professional tools and testing instruments to detect, debug and replace defective and malfunctioning terminals and application modules	
4	**IoT Engineering Application Development and Debugging**	**20**
Basic Requirements	● Knowledge of IoT platform private cloud and public cloud architecture, communication protocol standards and IoT protocol hardware driver development technology for industrial	

	equipment ● Web API, Android API, and desktop application development ● Common data analysis methods ● Basic database operation methods ● Rules engine knowledge ● Basic knowledge of Python, SQL, Java, C#, and C++ ● Application of security algorithms and encryption algorithms ● Basic principles and methods of user interface design	
Skills	● Prepare system development and application documentation ● Able to read technical documents and draw development and testing processes ● Able to use Python, C, C++, Java, C# and other programming languages ● Ability to troubleshoot software system failures and problems ● Be familiar with the linkage rules of IoT edge devices ● Use SQL statements to query the database ● Design user-defined product prototypes	
5	**Professionalism**	**3**
Basic Requirements	● Health and safety laws, obligations, regulations and documents ● Basic first aid knowledge ● The importance of recycling and safe waste disposal ● Work planning, time management and priority scheduling skills ● Principles of electrical safety work ● Situations where personal protective equipment (PPE) must be worn ● The importance of keeping the work area clean ● Quality and cost management ● Workflow and measurement principles ● The impact of new IoT technologies	
Skills	● Comply with health and safety standards ● Correct selection and use of personal protective equipment	

	● Select, use, clean, maintain and store tools and equipment safely and reliably ● Plan and organize the work area regularly ● Re-adjust work priorities according to changes in work tasks ● Regularly check project progress and evaluate results ● Reduce waste and management costs ● Maintain work efficiency and quality, standardize management	
Total		**100**

3 Scoring Plan

3.1 Scoring Method

The scoring of this competition will be completed by the referee team offline. If a contestant cheats or commits other violations during the competition, the referee will handle it according to the violation, and the result will be cancelled if the violation is serious.

3.2 Scoring Rules

1. Those with higher total scores will be ranked first;

2. For candidates with the same total scores, the order of Module A, Module B, Module C, and Module D is given, and the candidate with the higher module score will be ranked first.

When the above two rules cannot be used to rank the players, the judging panel will conduct a comprehensive evaluation vote on all subjective scoring items (evaluations) of the competition modules of the players with the same ranking in the group, and the player with the highest vote will be ranked first in terms of total score.

3.3 Evaluation Basis

During the competition design process, the selection of standards and evaluation methods will be determined through the scoring scheme and competition questions.

Evaluation basis includes but is not limited to:

- Completeness and standardization of the operation process
- Correctness of process drawing, correctness and standardization of code
- Visual APP displays the completeness and correctness of the page
- Proficiency in application of IoT competition platform
- The process, completeness and correctness of equipment installation
- Troubleshooting results
- Personal protection

4 Competition Questions

4.1 Common Precautions

Whether consisting of a single module or a series of independent or interrelated modules, the competition questions are capable of assessing the application of knowledge, skills, and behaviors outlined in the relevant standards.

Combined with the scoring scheme, the purpose of the competition questions is to provide a comprehensive, balanced, and authentic opportunity for evaluation and scoring in accordance with established standards. The relationship among competition questions, scoring schemes, and standards serves as a key indicator of quality, much like the relationship between standards and actual job performance.

The competition questions do not extend beyond the defined standards and do not

compromise the balance of scoring within those standards.

The assessment of knowledge and understanding is conducted solely through their application in real-world scenarios as reflected in the competition questions.

4.2 Competition Question Format/Framework

The competition topic consists of 4 relatively independent and related modules:

Module A: IoT Engineering Design and Implementation

Module B: IoT Engineering Maintenance and Optimization

Module C: IoT Engineering Application Development and Debugging

Module D: Work organization and management and professionalism

4.3 Competition time allocation and score weight

Module	Time(min)	Score Weight(%)
Module A: IoT Engineering Design and Implementation	120	55
Module B: IoT Engineering Maintenance and Optimization	60	20
Module C: IoT Engineering Application Development and Debugging	60	20
Module D: Work organization and management and professionalism	0	5
Total	240	100

Note: There is no separate time limit for Module D. The score for Module D will be based on the overall performance of the contestants throughout the competition.

4.4 Competition Content and Requirements

The Internet of Things competition consists of four modules, including: Internet of Things engineering design and implementation, Internet of Things engineering

maintenance and optimization, Internet of Things engineering application development and debugging, work organization management and professional quality, which comprehensively examines the contestants' Internet of Things technical capabilities.

Module A: IoT Engineering Design and Implementation

According to the scenario requirements, choose appropriate hardware, software and services, and select, connect and configure various IoT devices such as sensors, identification devices, wireless sensor networks, smart gateways, etc.

Module B: IoT Engineering Maintenance and Optimization

According to the scenario requirements, perform function and performance diagnosis on the hardware equipment and wiring involved in the IoT project, and troubleshoot according to the diagnosis results. According to business needs, make full use of the equipment and facilities of the original system to design the IoT project construction plan for the upgraded system. Improve the performance of the hardware and software equipment involved in the IoT system by maintaining the system, optimizing performance, adjusting system policies, setting scheduled tasks, updating parameters, etc. Realize the user project upgrade requirements by correctly configuring the relevant IoT devices.

Module C: IoT Engineering Application Development and Debugging

Use the integrated development environment tools to develop IoT platform applications on the competition computer; through application development, complete the process of obtaining specific data required by the topic from the IoT platform and displaying the data on the specified terminal display device in the specified mode. Perform functional and performance checks on the required result display, make

corrections and modifications, debug the program to complete the required application development, and keep the application running continuously and display the running results.

Module D: Work organization and management and professionalism

With reference to the performance during the competition, combined with the requirements of the Internet of Things project, comprehensive consideration is given to teamwork, organizational management, work flow, construction standards, construction quality, implementation of rules and regulations, proficiency in equipment use, storage standards, cost management and other aspects.

4.5 Competition Questions Announcement Plan

The competition questions will be announced through the official website of the competition or other methods approved by the organizing committee.

4.6 Competition Questions Adjustment Plan

Before the official competition, the competition questions will be modified by approximately 30%.

5 Skills Management and Communication

5.1 Expert Group

The skill expert group is composed of the chief expert, deputy chief expert and expert members, who are responsible for further revising the technical documents for the final of this competition and daily skill management.

5.2 Communication and discussion

Before the competition, participants can enter the Internet of Things event communication group to provide feedback on any questions related to software and hardware preparations, examination environment deployment, etc. Online communication will be conducted using the instant messaging tools "QQ/ wechat", and the format of the offline discussion forum will be uniformly announced by the organizing committee with the meeting time.

6 Security Requirements

1. Participants must strictly abide by the competition rules and operating procedures, pay attention to personal and equipment safety, accept the supervision and warnings of the referees, and compete in a civilized manner.

2. Participants should understand the performance parameters of the equipment in advance to ensure the correct use of the equipment.

3. Participants must pay attention to the short circuit of the positive and negative poles of the power supply to avoid burning out the equipment and causing safety accidents.

4. When installing the equipment, the contestants should keep the power supply of their workstations off and must not connect the equipment while it is powered on. If any leakage of electricity or other phenomena are found, report to the referee in time and contact the technical personnel to inspect the equipment.

5. Participants must pay attention to anti-static safety and must not place circuit boards on metal surfaces or stack them without protection.

6. Contestants should pay attention to the safe use of high voltage electricity at their

workstations.

7. Participants are not allowed to interfere with other teams during the competition.

7 Equipment and Materials

7.1 Infrastructure List

The infrastructure list details all the equipment and facilities that participants need to prepare, see "Infrastructure List for the Online Remote Finals of the BRICS Skills Competition (BRICS+ Future Skills & Tech Challenge)".

7.1.1 Equipment List

No.	Device Name	Quantity
1	IoT System Integration Engineering Training Platform	1
2	IoT Toolbox and Consumables Kit	1
3	Tool Table	2
4	Computer	2

IoT System Integration Engineering Training Platform(NLE-ISE840)

7.1.2 Software Environment

No.	Category	Software Title
1	software	Microsoft windows 10（64bit）Trial
2	software	Ubuntu 18.4 and above
3	software	Microsoft Office 2016 (Trial)
4	software	Microsoft Visio 2016 (Trial)
5	software	DevEco Studio 4.0 Release
6	software	OpenHarmony 4.0 Release
7	software	PyCharm Community Edition 2022.1
8	software	Python 3
9	software	Debugging software, network scanning, listening tools, serial port debugging assistant, etc.
10	software	Oracle VM VirtualBox (Trial)

7.2 Contestant's toolbox

The competition equipment is provided by the competition organizer. It is prohibited to bring your own equipment, materials and tools.

7.3 Prohibited Materials and Equipment

Participants must declare (show) their own equipment and materials to the Experts. Experts may prohibit participants from using any items that are not relevant to the task or that may bring unfairness to other participants.

7.4 Suggested Competition Area and Workstation Layout

The venue must meet the area requirements corresponding to the number of workstations in each functional area and parameter team for the competition. Good lighting, illumination and ventilation; Provide stable water, electricity and power supply emergency equipment.

Competition venue.

(1)The competition site is equipped with a competition area, a referee area, a service area and a technical support area. Ensure good lighting, illumination and ventilation on site. Provide stable water, electricity and power supply emergency equipment. At the same time, one lounge is provided for all the instructors.

(2)Competition equipment. The competition area prepares the necessary software and hardware platforms for the competition according to the number of participating teams and provides standard competition equipment for them.

(3)Competition workstation. Each working area at the competition site is equipped with a single-phase AC power supply of 220V/3A or above. Each competition

workstation is marked with a number. Each competition room is equipped with a workbench for placing computers and other debugging equipment and tools, etc. It is equipped with 2 work chairs (stools).

(4) The technical support area provides contestants with public spare parts and other competition-related equipment. The service area provides medical and other service guarantees.

8 Competition Guidelines

8.1 Notes for Teams

(1)Each participating team must purchase personal accident insurance for the contestants during the competition.

(2)Each participating team must manage and educate the contestants and their team leaders on safety. The team leaders should keep their communication channels open during the competition.

(3)All participating teams should abide by and implement the arbitration results. For any malicious appeal, once verified, the organizing committee will hold the relevant personnel accountable.

(4)The team leader is responsible for the management and organization of the participating team during the competition.

8.2 Notes for Team Leaders

(1)The team leader must strictly abide by the competition and all rules, comply with the arrangements and management of the event executive committee, and strengthen the management of the participants, making all necessary preparations.

(2)The team leader is responsible for drawing the team numbers of the participating teams and is not allowed to enter the competition site during the competition.

(3)The team leader is responsible for coordinating and communicating with the organizing committee of the competition during the event.

(4)If a participating team believes that any matter that does not comply with the competition regulations has occurred, the team leader shall submit a written appeal material signed and confirmed to the competition arbitration group within 2 hours after the competition ends. The oral appeal is invalid and will not be accepted by the arbitration panel.

8.3 Notes for Contestants

1)Contestants should strictly abide by the competition rules and operating procedures, ensure personal and equipment safety, accept the supervision and warnings of the referees, and compete in a civilized manner.

(2)Participants shall enter the competition with the participation certificate issued by the organizing committee and valid identification (ID card or passport).

(3)Contestants shall enter the competition venue at the prescribed time, confirm the

on-site conditions and sign. Operate in accordance with the unified instructions. Each participating team independently decides on the division of labor among the contestants, the work process and the time arrangement, and completes the competition at the designated workstation within the prescribed time. Do not enter the workstations of other teams at will.

(4)After entering the venue, contestants should confirm whether the competition equipment and tools are safe and in good condition in accordance with the regulations, strictly abide by the competition rules and operating procedures, and ensure personal and equipment safety.

(5)During the competition, if the competition equipment malfunctions due to factors not attributable to the contestants themselves, please promptly signal the on-site referee. Technicians will then repair or replace the competition equipment. The referee team may, depending on the specific circumstances, add time to the time spent on troubleshooting.

(6)When installing and deploying the competition equipment, contestants are requested to thoroughly understand the performance parameters of each device, such as power supply input, etc., to ensure the normal operation of the equipment.

(7)When connecting sensors and other devices, contestants should be careful to prevent short circuits between the positive and negative poles to avoid burning out the equipment. Do not touch or open the distribution box at the training workstation. Pay attention to the safety of using the 220V strong current behind the workstation.

(8)During the competition, food and drinking water will be provided uniformly at the venue. The time for contestants to rest, eat and use the toilet is all included in the competition time.

(9)After the competition, the participating teams need to clean up the site and restore the venue to its pre-competition state.

(10)During the competition, if any contestant refuses to follow the referee's instructions or disrupts the order of the competition venue, the chief expert will deduct the score of the participating team at his discretion. Those with serious circumstances will be disqualified from the competition. Those who cheat will be directly disqualified from the competition.

8.4 Notes for Staff

(1)The competition venue staff are uniformly hired by the event executive committee and assigned tasks.

(2)Obey the leadership of the event executive committee, abide by professional ethics, adhere to principles and act in accordance with regulations. Do the work with a highly responsible spirit, a serious and conscientious attitude, and a meticulous and rigorous style.

(3)Be familiar with the "Technical Regulations" and strictly implement the competition rules.

(4)Stay at your post and do not be late, leave early or leave without permission.

(5)The staff at the competition venue should actively maintain the order of the venue to facilitate the normal performance of the contestants.

(6)Staff members are not allowed to answer any technical questions raised by the contestants during the competition. In case of any disputes, they must be reported to the executive committee.

(7)Those who violate the regulations and cause impact or losses to the competition

will be dealt with as necessary.