



TECHNICAL DESCRIPTION

Internet of Things (offline)

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1 Introduction

1.1 Name and description of skill competition

1.1.1 Name of skills competition

Internet of Things

1.1.2 Description of skills competition

The BRICS Skills Competition (Internet of Things) – Offline Competition is organized based on a platform built by the Internet of Things (IoT) competition platform. This platform is composed of IoT cloud application platform, IoT competition platform, IoT cloud platform, AOT platform system, etc. Players need to complete the offline operation through computers and tools. The IoT offline competition is a team skill competition, and each team has two players.

The skills to be assessed include: IoT equipment selection and engineering design capability, installation and debugging capability IoT software and hardware, IoT system integration and building capability, IoT platform configuration and management capability, IoT application development capability, and professionalism.

1.2 Relevance and significance of this document

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

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

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

2 Skill standard

2.1 General description of skill standard

The skill standard specifies knowledge, understanding and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business.

The skills competition is aimed to reflect international best practice as described by this skill standard, and the extent to which it can achieve. Therefore, the standard is a guide for the training and preparation required for the skill competition.

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

A percentage is given each section to indicate how important it is compared with the other sections

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in the standard. This is often called a "weight". The total score which is 100 corresponds to 100%, the sum of all the percentages. Weights determine the distribution of scores in the score standard.

With test items, the grading scheme assesses only the skills listed in the criteria. They will reflect the standard as fully as possible within the constraints of the skill competition.

The scoring scheme will be based on the points assigned in the criteria to the extent practical. A 5% change is allowed, but must not change the weight assigned by the standard specification.

2.2 Skill standard

Section		Weight (%)
1	Work organization and management	
Basic knowledge	<ul style="list-style-type: none"> ● Technical specifications and terms related to safe production, as well as special requirements for specific positions ● Basic knowledge of lean production Honesty and integrity ● Self-motivation, solutions to the problems of teamwork, and efficient work under pressure ● Regulations, obligations and documentation on health and safety, and best practices related to skills ● Principles of safe use of electricity 	
Work capacity	<ul style="list-style-type: none"> ● Keep professional under the relevant occupational environment and other factors ● Collaborate with colleagues and teams in local and remote environments ● Present ideas to teams or customers, and respond to customers' needs ● Ensure the safety of yourself and others in the workplace ● Take appropriate precautions to minimize accidents and their influence ● Adopt the process recording in compliance with international standards to ensure the traceability of development and correction ● Interpret and recognize the international symbols and international language used by other standard bodies ● Assist engineers in preparing reports and records on testing technology, laboratory equipment and testing procedures ● Communicate with customers effectively 	2

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	<ul style="list-style-type: none"> ● Train other personnel to use facilities and equipment ● Act professional to meet the customers' requirements ● Enable the maintenance policy for process recording 	
2	IoT theory	18
Basic knowledge	<ul style="list-style-type: none"> ● Communication and design for user needs ● Basic knowledge of common IoT application software ● Normative knowledge of installation and wiring standard ● Basic concept, structure and function of the IoT terminal, and methods of reading and writing the IoT identification information ● Fundamental theory of computer operation and communication ● The method to download and install the applications ● Identification of commonly used symbols for electrical equipment ● Electrical equipment installation ● Safety knowledge of working in strong and weak current environments and the use of drawing tools 	
Work capacity	<ul style="list-style-type: none"> ● Have the ability to communicate and cooperate ● Have the ability to read requirement documents in systems ● Have the ability to understand and explain electrical schematic diagrams ● Be proficient in the use of drawing and design software ● Have the ability to prepare project design documents and reports using normative documents that comply with international and national standards ● Have the ability to test network patch cables with instruments 	
3	Internet of Things Engineering Design and Realization	50
Basic knowledge	<ul style="list-style-type: none"> ● The method and skill to use common professional tools, the operation and measurement methods of common detection instruments, and application of electrician's tools and debugging tools ● Installation and debugging of the IoT terminal equipment through wired and wireless network environments, the circuit working principle troubleshooting, testing and maintenance, and their environmental conditions ● Restrictions and usage of testing equipment and tools ● Preventive judgment of unreliable terminal equipment in application scenarios, and patrol inspection, testing, and maintenance technology for electrical equipment 	

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	<ul style="list-style-type: none"> ● System software technology of cloud platform, and the building, configuration and connection of network environment ● Display method of Modbus RTU/Modbus TCP standard communication protocol to collect data 	
Work capacity	<ul style="list-style-type: none"> ● Select network cables and make network patch cables with tools ● Correctly select and use routers and have the ability to build and configure wired and wireless network environments ● Correctly add and manage IoT equipment and set the parameters ● Be able to configure and use serial port debugging tools and software correctly ● Be able to complete real-time data display and scenario linkage ● Have the ability to read and understand software and hardware manuals ● Determine the cause of the run-time error and the measures to be taken ● Test, debug and replace defective and abnormal terminals and application modules with professional tools and testing instruments 	
4	IoT application development and debugging	
Basic knowledge	<ul style="list-style-type: none"> ● Architecture knowledge and communication protocol standard and IoT protocol of private cloud and public cloud of IoT platform, IoT protocol and hardware-driven development technology for industrial equipment ● Development of Web API, Android API, and desktop application ● Common data analysis method ● Basic operation method of database ● Rule 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 	30
Work capacity	<ul style="list-style-type: none"> ● Compile system development and application documentation ● Be capable of reading technical documents and drawing the development and testing process ● Be capable of using programming languages such as Python, C, C++, Java, C#, etc. ● Have the ability to troubleshoot software system failures and solve the problems ● Be familiar with IoT edge device linkage rules 	

	<ul style="list-style-type: none">● Query data in database using SQL statements● Design product prototypes meeting the user needs	
Total		100

3 Scoring scheme

3.1 Scoring method

The competition will be scored offline by the judge panel. If a player cheats or violates the specified rules during the competition, the judge will punish the player according to the specific violation. If the circumstances are serious, the score will be cancelled.

3.2 Scoring rules

1. The total score of the player will be arranged in descend order;
2. If the total score is the same, in the order of module B, module C, and module A, the total score of the player from the modules will be arranged in descend order.

When the rankings of players cannot be clearly given according to the two methods mentioned above, the judges will comprehensively evaluate and vote on all subjective scoring items (evaluations) of the competition modules for the players with the same total scores, and the player with the most votes will be ranked ahead of the other player.

3.3 Evaluation basis

During the competition design process, the standard and evaluation methods will be determined through the scoring scheme and evaluation items.

Evaluation basis, include but is not limited to:

- Integrity and standardization of the operation process
- Correctness of process drawing, and correctness and standardization of code
- Completeness and correctness of visualized APP display page
- Proficiency in using IoT competition platform
- Technology, integrity and correctness of equipment installation
- Results of troubleshooting
- Personal protection

4 Test items

4.1 Common precautions

Whether a single module or a series of independent or linked modules, evaluation items cover the application of the knowledge, skills and behaviors defined in the standard.

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

The evaluation items do not include the contents beyond the standard and do not affect the balance of scoring within the standard.

For evaluation items, the knowledge and understanding are evaluated solely through their application in actual work.

4.2 Format/framework of evaluation item

The evaluation items are composed of three relatively independent and related modules:

Module A: IoT theory

Module B: IoT engineering design and implementation

Module C: IoT application development and debugging

4.3 Time allocation and score weight of evaluation items

Module	Duration (min)	Score weight (%)
Module A:IoT theory	180	20
Module B:IoT engineering design and implementation	300	50
Module C:IoT application development and debugging	240	30
Total	720	100

4.4 Contents and requirements of each module

The IoT competition consists of 3 modules, namely, IoT theory, IoT engineering design and implementation, IoT application development and debugging, to evaluate comprehensive IoT technology capabilities of the competitors.

Module A IoT theory

The theoretical knowledge test is mainly closed-book written test and computer-based test to exam the competitors on the basic requirements and relevant knowledge requirements. The content of the assessment includes the knowledge related to the electronic circuit, sensor, computer network, sensor network, etc.

Module B IoT engineering design and implementation

According to business needs, select appropriate hardware, software and services, and select, connect and configure various types of sensors, identification devices, wireless sensor networks, intelligent gateways and other IoT equipment;

Module C IoT application development and debugging

Implement the IoT application development on the computer for the competition by the integrated development environment tool; through the application development, obtaining the required data from the IoT platform, and display the data on the specified terminal display device under the specified mode. Check the function and performance of the required result display, correct, modify, debug the program to complete the required application development, and maintain the continuous operation of the application program and the display of the running results.

4.5 Announcement of evaluation items

The evaluation items will be announced on the official website of the competition or other methods approved by the organizing committee

4.6 Changes of evaluation items

The evaluation items will be changed by 30% before the official competition.

5 Skill management and communication

5.1 Expert panel

The expert panel is composed of chief experts, deputy chief experts and other experts, and is responsible for further revision of the technical documents of the remote finals of this competition and daily skills management.

5.2 Discussion forum

Before the competition, the participants can enter the forum of the IoT training and competition platform to give feedback on relevant questions such as software and hardware preparation, and

examination environment deployment. The participants can communicate with one another during the training, before the competition, during competition or after the competition through the forum.

The instant messaging tool "Tencent QQ" will be used for online communication, and the discussion forum will be held for offline communication at the time that will be uniformly announced by the organizing committee.

6 Safety requirements

1. Competitors must confirm that the work position, equipment and tools are safe and intact according to the regulations, strictly abide by the rules of the venue and operating procedures, pay attention to the personal and equipment safety, accept the supervision and warning of the judge, and compete in a civilized manner.

2. Before the competitors install the equipment used for the competition, they shall understand the performance parameters of the equipment in advance to ensure the correct use of the equipment.

3. When installing the equipment such as sensors, competitors must pay attention to the positive and negative poles of the power supply to avoid damage to the equipment and safety accidents caused by the short circuit.

4. When the competitors install the equipment, they shall keep the power supply at the work position off, and must not connect the equipment with power on. In case of the phenomena such as any leakage of electricity, the competitors should report it to the judge in time, and contact the technical personnel to check the equipment.

5. Competitors should pay attention to anti-static safety during the installation of equipment, and must not place circuit boards on a metal surface or stack them without protection.

6. Competitors should not touch and open the power distribution box at the work position for practical training, and pay attention to the safety of the 220V strong current behind the work position.

7. Competitors are not allowed to enter the work position of other teams during the competition, and must not interfere with the competition process of other teams.

7 Materials and equipment

7.1 Infrastructure list

The infrastructure list gives all the equipment and facilities required by the participants, see "Infrastructure List for 2022 BRICS Skills Competition Offline Competition (Internet of Things) - Online Competition".

7.2 Competitors' toolbox

The competitors are not allowed to bring their own equipment, materials and tools for use in the

competition venue, and all equipment, materials and tools will be provided by the competition organizer.

7.3 Materials, equipment and tools brought by competitors

The competitors are not allowed to bring their own equipment, materials and tools for use in the competition venue, and all equipment, materials and tools will be provided by the competition organizer.

7.4 Materials and equipment prohibited in the competition area

Competitors are not allowed to carry any materials and equipment. Experts may prohibit the use of any item that is irrelevant to the performance of the task or that may allow the competitor to attain unfair advantage over other competitors.

7.5 Recommended layout of competition area and work position

