The First World Vocational College Skills Competition Competition Rules

I. Name of the Skill

No.: W09

Chinese name: 物联网技术应用

English name: IoT Technology Application

Industry: Electronic information industry, strategic emerging industries

II. Competition Purpose

The World Vocational College Skills Competition (the "Competition") aims to bring together standards, technologies, equipment, teachers and students in the field of vocational and technical education at home and abroad, promote China's vocational education to go global and serve international cooperation in production capacity, build an important platform for teachers and students of international vocational schools to deepen friendship, exchange skills and show expertise, and promote the development of a world community of skills. Through the skills competition, expertise show and experience exchange, this Competion can be a platform to share the best practices of international vocational and technical education, enhance the influence of China's vocational and technical education in the world in this field, and promote the development of China's vocational and technical education in line with global vocational and technical education.

Nowadays, the world has entered the smart era as the technological revolution featuring artificial intelligence is sweeping across the globe. As one of the key supporting technologies in the smart era, IoT technology is a strategic emerging industry to which countries around the world attach great importance. With the continuous breakthroughs in key IoT technologies, the strength of the entire industry has been continuously improved and the industry applications have been expanded. The rapid development of the IoT industry has set new requirements for IoT practitioners, and a large number of international and highly qualified technical and skilled elites who are familiar with industrial development, master cutting-edge technologies and have rich project experience are needed urgently.

The purpose of the Competition is to conform to the new situation of international integration of the IoT industry, strengthen the exchange and cooperation in IoT technology among countries, and give full play to the leading and demonstration role of the Competition, reflecting the new concept, new changes and new themes of vocational education development in the post-pandemic era. The Competition will promote the building of technical and skilled talent teams in the field of IoT vocation in each participating country or region, enhance the social recognition of IoT practitioners, advance innovation and entrepreneurship, cultivate and select more high-quality technical and skilled elites with high technical level and engaged in IoT engineering construction, and contribute to the building of a human community with a shared future.

III. Competition Content

Oriented towards the development needs of the IoT industry, based on the international

standards of IoT technology, professional standards and job requirements, and relying on the complete business procedure under real IoT application scenarios, the Competition is to assess the competitors' comprehensive ability in the IoT project construction and implementation, especially the resilience and innovation, mainly including: IoT engineering design and equipment selection, IoT hardware and software installation and debugging, IoT system integration and construction, IoT platform configuration management, IoT application innovation, as well as communication and presentation competence and professionalism.

This project requires the competitors to use professional tools and equipment to design, install, build, debug, configure and apply a set of IoT systems that can meet the needs and operate stably according to the project requirements, and examine the comprehensive vocational ability of the competitors through the implementation of real tasks, including the following contents.

Module No.	Module	Competition duration (hour)	Score
A	Design of an implementation plan for the IoT project		15
B	Installation and debugging of IoT equipment	6	50
C	Innovation in the IoT technology application		20
D	Presentation of IoT project results		15
Total		6	100

i. Brief description of modules

Module A: Design of an implementation plan for the IoT project

This module is to assess competitors' ability of overall design for the IoT project, as well as the ability to select equipment, draw diagrams and write documentation. According to the IoT architecture and protocol standards, competitors need to complete the design of the IoT project solution and implementation plan by analyzing the project requirements, and validate the designed plan using a virtual simulation system. Key points to be assessed include: project schedule development, system architecture design, IoT equipment selection, software selection, IoT gateway access design, and IoT sub-system design.

Module B: Installation and debugging of IoT equipment

Competitors are required to select suitable hardware, software and services to install and configure various sensors, identification devices, wireless sensor network communication devices, intelligent gateways and other IoT devices, connect and construct the IoT network transmission layer, use and operate application scenarios, configure and deploy IoT middleware and services, and use real equipment or virtual simulation environment for IoT project implementation and deployment, so as to achieve user project requirements.

Module C: Innovation in the IoT technology application

Competitors are required to combine various types of IoT software and hardware devices and platforms for application innovation, install and connect hardware devices and develop

software systems for the application scenarios defined by the task, and design and implement IoT application systems that meet the requirements of the application scenarios and have a certain practical value.

Module D: Presentation of IoT project results

Competitors are required to produce project presentation resources (e.g., PowerPoint) to introduce the functions, ideas, principles and effects of the engineering project built in Module B and the innovative system in Module C. Student competitors present and demonstrate the functions to the jury through explanations and operating demonstrations, and are questioned by the jury.

ii. Competition duration

The Competition will take six hours in total for competitors to complete the required tasks of the four modules. If a delay is required due to special circumstances during the Competition, the jury president will rule on the case based on the reality.

IV. Competition Method

i. Team formation requirements
1. "0.5+0.5" hand-in-hand Chinese-foreign mixed team ("mixed team") is adopted, which consists of one Chinese student and one foreign student. Competitors should sign up, compete and win prizes in teams.
2. Domestic competitors must be registered full-time students in higher vocational colleges, as well as registered undergraduate students in vocational colleges.
3. Foreign competitors must be foreign full-time students in related majors of vocational schools or colleges and universities providing vocational education, and international students of undergraduate schools in China are also encouraged to participate.
4. Competitor replacement: If a competitor is unable to participate for any reason during the preparation, the relevant department should issue a written explanation ten working days before the start of the corresponding Competition. The competitor will be replaced after verification by the office of the Executive Committee of the Competition ("Executive Committee"). After the Competition starts, the team is not allowed to replace the competitor.

ii. Competition method
Domestic competitors will compete on site; if foreign competitors are unable to attend the on-site competition, they will compete through recorded broadcast. Foreign competitors must send the competition video that meets the competition requirements to the mailbox designated by the Executive Committee seven days before the official competition day, and the Executive Committee will check and try to broadcast the videos and seal them for the record. On the official competition day, the videos should be unsealed by the jury, and those from the foreign competitors should be broadcast on the big screen on site. The marking criteria should be the same as those for on-site competition.
Requirements for competition video: The file format is MP4; the resolution is not less than 1280*720, the recommended aspect ratio is 16:9, and the video content needs to fully display the competition process.

V. Competition Process

i. Competition milestones and timeline

Date	Time	Milestone
Pre-competition Day 1	08:30-14:00	Teams registration
	14:00-15:00	Competition briefing
	14:00-15:00	Competitors familiarize themselves with the venue
Day 1	08:00-08:45	Venue check-in and draw for workstation
	08:45-09:00	Competitors enter the workstation and check the equipment
	09:00-11:30	Competition of modules A and B
	12:30-14:30	Competition of module C
	14:30-16:00	Competition of module D
	16:00-18:00	Marking by judges
	18:00-20:00	Summary of results
Day 2		Announcement of results, prize presentation and closing ceremony

ii. Competition Process Flow Chart
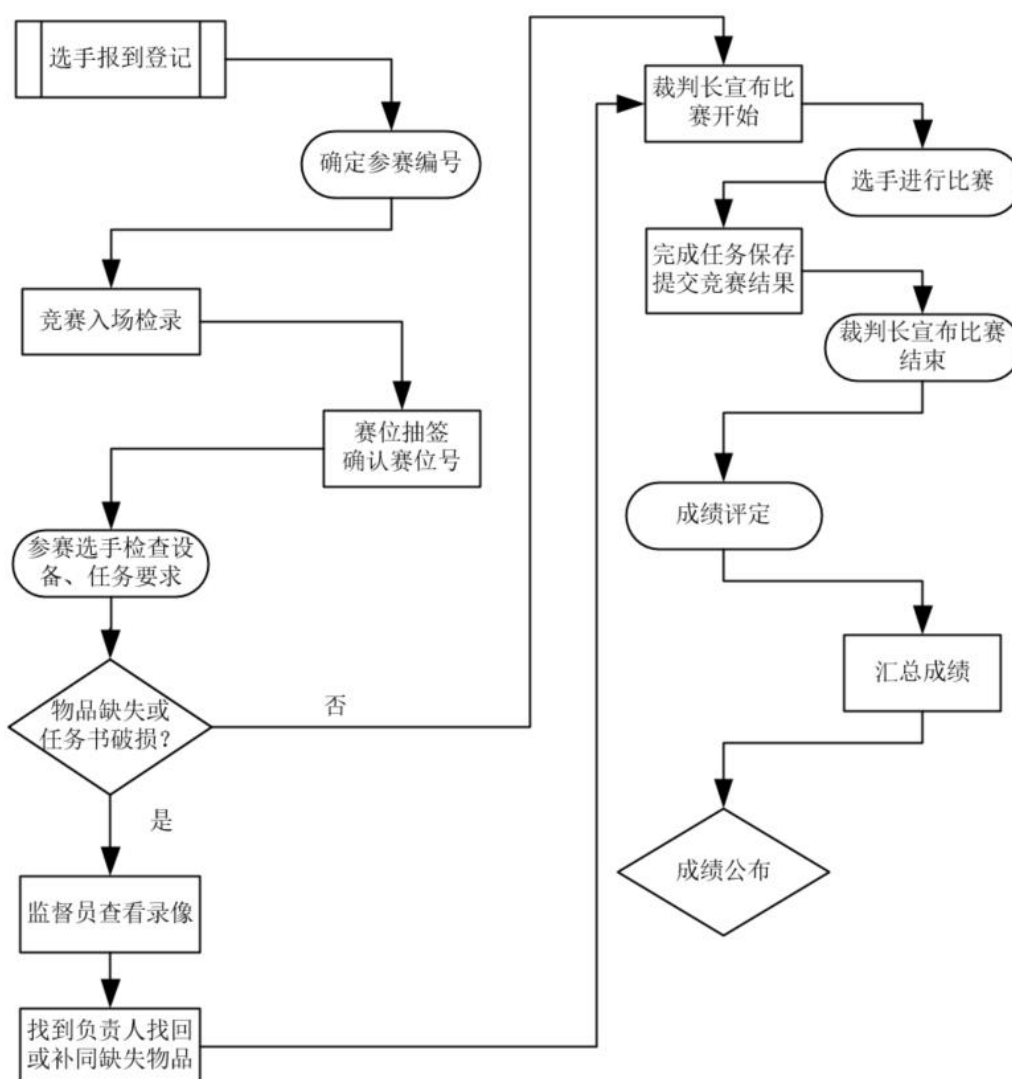
Registration for competitors	Registration for competitors
Determination of race number	Determination of race number
Check-in	Check-in
Assignment of workstations by drawing lots	Assignment of workstations by drawing lots
Competitors check equipment and task requirements	Competitors check equipment and task requirements
Missing items or damage to the TP?	Missing items or damage to the TP?
No	No:
Yes	Yes
Supervisors view videos	Supervisors view videos
Find the person responsible for recovering or replacing the missing item	Find the person responsible for recovering or replacing the missing item
Jury president announces the start of the Competition	Jury president announces the start of the Competition
Competitors compete	Competitors compete
Complete tasks, and save and submit the results	Complete the tasks and save and submit the results
Jury president announces the end of the Competition	Jury president announces the end of the Competition
Result Evaluation	Result evaluation
Result summary	Result summary
Result announcement	Result announcement

iii. Competition process

1. Entrance and positioning of competitors

Competitors use the lottery number received at check-in to draw the workstation number, and check the workstation number at the entry to find and take the workstation at the venue for the start of the Competition.

2. Competition process

After the jury president announces the start of the Competition, each competitor will officially compete, completing each project task in accordance with the project requirements on the Tset Project ("TP") provided at each workstation, and submit and save the results as required.

3. End of the Competition

When the time stipulated for the Competition ends, the jury president will announce the end of the Competition, and competitors should stop all operations and leave the venue in an orderly manner as required by the jury.

VI. Competition Task Paper

The design expert panel appointed by the Executive Committee is responsible for the design of this competition task paper. In accordance with the content requirements of the Rules, the direction and difficulty are determined based on the relevant professional training standards of vocational schools and national occupational standards, as well as the training requirements of IoT talent and the position needs of IoT enterprises. After completing the paper design, the competition task paper will be submitted to the experts appointed by the Executive Committee for review. competition task paper will be made public through the Competition information release platform one month before the start of the Competition.

VII. Competition Rules

i. Rules for check-in and entry

1. Competitors should arrive at the designated area five minutes before the specified time.

2. The judges will check the identity of each competitor. Competitors must provide valid documents such as entry card, ID card (passport), and student card (provided by students). The name, age and facial features on the documents should be consistent.

3. Competitors are not allowed to bring any communication and storage devices, paper materials, etc.

4. Competitors will be checked in and draw for the workstation number.

5. Competitors should take the workstation with the workstation number.

6. It is strictly forbidden to touch the Competition facilities without the permission of the judge before the start of the Competition. Competitors shall not leave the venue during the Competition.

ii. Venue rules

1. The Executive Committee will provide Competition equipment such as Competition platform equipment, computers, consumables and related software as well as Competition materials such as the TP on site.

2. Each team must have all the competitors registered onto the venue to compete, and competitors should work with each other to complete the TP.

3. If a competitor is unable to compete due to the pandemic or other special reasons, a written application must be submitted to the Executive Committee in advance, and an alternate may compete after being approved by the Executive Committee. The alternate must be of the same nationality as the competitor replaced, and Chinese competitors are allowed to replace foreign competitors.

4. During the Competition, competitors must strictly observe the safety operating procedures, ensure personal and equipment safety, and accept the supervision and warnings of the on-site judges and technicians.

5. During the Competition, if there is a fault of the Competition equipment which is not caused by the competitors, the technical support team will repair or replace the equipment, and the jury will impose a delay according to the actual situation.

6. During the Competition, all personnel should respect the religious beliefs and habits of the competitors of each country or region and be supportive as far as possible without affecting the Competition.

7. During the Competition, if the competitors disobey the instructions of the judge and disturb the order of the venue, the jury president will deduct the mark of the team as appropriate; if the circumstance is serious, the competitor will be disqualified. If there is cheating, the competitor will be disqualified directly.

8. After the Competition, teams are required to clean up the venue and restore it to pre-Competition condition.

VIII. Competition Environment

i. Requirements of environment, facilities and equipment for Competition venue

1. Competition venue. The Competition venue is set up with a Competition area, judge area, service area and technical support area. Good light, illumination and ventilation should be ensured for the venue, and stable water, electricity and power supply emergency equipment should be provided.

2. Competition area. The number of workstations should be set according to the number of teams participating in the Competition, taking N + 1 to equip the number of workstations, i.e., N official workstations and one standby workstation. Each workstation should cover an area of not less than 12 m2. The total area of the Competition area is approximately 300 m2.

3. Competition workstation. Each Competition station can provide an independent single-phase AC power supply above 220 V/3A, and the power supply load should be not less than 1 kw with safe grounding protection. Each Competition workstation is marked with a number and equipped with a workbench for placing computers and other debugging equipment tools, as well as work chairs.

4. Competition equipment. All Competition equipment will be provided and guaranteed by the Competition partner enterprises and the organizer. The hardware and software platforms required for the Competition will be prepared according to the number of teams, and standard Competition equipment will be provided for the teams.

5. The technical support area provides relevant equipment such as common spare parts for competitors.

6. The judge area is equipped with computers, printers and other equipment and tools.

7. The service area provides food, drinking water, medical care and other service guarantees.

ii. Requirements of environment, facilities and equipment for display experience venue

A display area is set up around the Competition area to showcase new IoT technologies and equipment, covering approximately 100 m^2. The display area provides a 220 V AC power supply and a display stand.

IX. Technical Specifications

i. Industry and vocational technical standards for Competition projects

The Test Project for the Competition are based on the needs of enterprises for the training of talent of IoT-related occupations and are developed according to the following standards:

ISO/IEC 29182-5-2013 Information Technology - Sensor Network: Reference Architecture for Sensor Networks

National Vocational Skills Standard for IoT Installers and Commissioners

National Vocational Technical Skills Standard for IoT Engineering Technicians

GB/T 33474-2016 Reference Architecture for the Internet of Things

GB 50311-2016 Engineering Design Specification for Premise Distribution System

GB 21671-2008 Specification for the Acceptance and Evaluation of LAN Systems Based on Ethernet Technology

GB/T 34068-2017 Specification for IoT General Technology Smart Sensor Interface

GB/T 33745-2017 Terminology for the Internet of Things

ii. Technical platform standards of the Competition

The Skill Competition Committee provides the Competition platform, workstations and computers and related tools and software. Each team is required to set up an internal LAN, which can be configured by itself, and connect it to the system support platform. The Competition venue is controlled by network security, and information interaction inside and outside the venue is strictly prohibited.

Basic requirements:

1. The platform should meet ISO14443.ISO15693 and ISO18000 standards and China's CCC standards.

2. Platform support standards/protocols: ISO/IEC14443A/B/C.

3. Financial certification standards: EMVCo RF technology certification/Paypass certification/paywave certification/China Unionpay Quick payment certification, etc.

4. ISO 7816 Specification and the China Financial Integrated Circuit (IC) Card Specifications.

5. ISO7810 and ISO7811.

6. ZigBee transmission: meet the IEEE802.15.4/ZigBee standard specifications and meet the 2007PRO protocol stack.

7. International certification of the terminal: FCC Part 15 Class B, CE EMC Class B, and CCC.

8. IP65 shell protection, meeting the requirements of GB/T 4208-1993 standard.

9. Overall protocol covering narrow-band IoT LTE R13 NB-IoT.

X. Technology Platform

i. Competition equipment

No.	Type of equipment	Item	Equipment parameters	Unit	Quantity
I	Hardware	Perceptual layer kit	1. Infrared antithetical sensor Detection range: not less than ten meters Wavelength: 940 nm Output signal: relay output Operating voltage: 24V DC Installation method: wall mounting 2. Temperature and humidity sensor Measurement range: temperature -10-60°C, humidity 0-100% RH Accuracy: temperature ±0.5°C, humidity ±3% Rh Output signal: 4-20 mA Operating voltage: 12 V-24 V DC Installation method: wall mounting 3. Carbon dioxide transmitter	Set	1

Measurement range: 0-5,000 PPM
Accuracy: ±30 ppm +3% F.S
Output signal: 4-20 mA
Operating voltage: 12 V-24 V DC
Response time: less than 30 s
Installation method: wall mounting

4. Temperature, humidity and light sensor module
The default measurement resolution is 14 bits for temperature and 12 bits for humidity, which can be reduced to 12 bits for temperature and eight bits for humidity by sending a command to the status register
Measurement range: temperature 0-100% RH, temperature -40-+123.8°C, light 0-2,000 Lux
Accuracy: humidity ±3.0% RH, temperature ±0.4°C, light ±10%
Sensitivity spectrum: 880-1,050 nm
Output signal: analog
Operating voltage: 3.3 V DC

5. Human sensor module
Voltage level output: high 3.3 V, low 0 V
Delay time: adjustable (0.3 seconds-10 minutes)
Blocking time: no more than 0.2 seconds
Sensing range: less than 120 degrees, within seven meters

6. Flame sensor module
Detection wavelength: 700-1,100 nm
Detection distance: > 1.5 m

7. Switch value smoke detectors
Alarm sound: ≥ 85 dB
Static current: ≤ 200 uA
Alarm current: ≤ 50 mA
Output signal: relay non-contact output
Operating voltage: 9 V-28 V DC
Smoke sensitivity: 0.15-0.3 dB/m
Installation method: wall mounting

8. Air quality sensor module
The sensor can detect low-concentration cigarette pollutants in the air with high sensitivity to H_2 and CO, and detect H_2 levels at several ppm levels. Measurement range: 1-30 ppm
Sensitivity: 0.15-0.5 ppm
Output signal: variable resistance value
Operating voltage: 3.3 V DC

9. Combustible gas sensor module
The sensor can respond to various combustible gas concentrations
Measurement range: 500-10,000 ppm
Sensitivity (resistance ratio): 0.55-0.65

			10. Human infrared switch Output signal: 0-1 Delay time: 6 s-5 min adjustable Sensing distance: 0-10 meters Operating voltage: 24 V DC 11. Noise sensor Output signal: 4-20 mA Response time: less than 2 s Measurement range: 30 dB-120 dB Resolution: 0.1 dB Measurement error: less than ±0.5 dB Frequency-weighted characteristics: A-weighted Frequency response: 20 Hz-12.5 kHz 12. Alarm light Red, green and yellow LED lights Maximum voltage: 0.1 A, 2.4 W Anti-vibration: 10-2,000 Hz, 1 mm, 15 g Protection class: ≤ IP65 13. DC electric actuator Operating range: 200 mm Operating speed: 20 mm/s Maximum thrust: 500 N 14. Travel switch Direct self-resetting travel switch 15. Limit switch Operating force: 2-3.8 N Compounding force: 1 N Repeatability error: less than ±0.05 mm 16. BeiDou positioning module The module is equipped with an RS-485 serial port, supporting full and half duplex serial communication; Serial port parameters support configuration via serial commands. Support for antenna detection and antenna short-circuit protection.		
II	Hardware	Sensor network it	1. ZigBee smart node Provide users with wireless data transmission function using ZigBee networks. Suitable for 2.4 GHz, IEEE 802.15.4, ZigBee and RF4CE applications. Provides a standard RS485 interface, which can be used via a USB cable. Connect to a PC for data communication. Externally powered or powered by a self-equipped battery. Operating voltage: 5 V DC Battery capacity not less than: 1,000 mAh Wireless frequency: 2.4 GHz Wireless protocol: ZigBee2007/PRO	Set	1

| | | | | Receiving sensitivity: not less than -96 dBm | | |
| | | | | | | |

Receiving sensitivity: not less than -96 dBm

2. RS485 equipment (digital)
At least seven DI available
At least eight DO available
DO channel supports pulse output
LED indicator available
Digital filter function available
Over-current/short-circuit protection
3 KV EFT and 8 KV ESD protection

3. NB-IoT module
Built-in Cortex-M3 (32-bit), support 32 kHz to 32 MHz of main frequency and 24 channels of ADC (12-bit).
Support frequency bands B8 (900 MHz) and B5 (850 MHz).
Support AT commands: 3GPP TR 45.820 and other AT extension commands.
Support UART download.
Support OLED liquid crystal.
Support the SWD debugging interface.
Support sensor extension interface.

4. LoRa module
Wireless operating band: 401-510 MHz.
Wireless transmitting power: Max. 19±1 dBm
Receiving sensitivity: -136±1 dBm (@250 bps).
LoRa modulation, compatible with and supporting FSK, GFSK, OOK conventional modulation.
Support frequency hopping of hardware (FHSS).
The communication interface to the MCU shall be SPI.
On-board M3-core microprocessor with maximum main frequency, SWD debugging interface, UART program download.
Support OLED screens.
With extension interface for connection of various small modules of experiment box sensors.
Support full-speed USB 2.0 interface.

5. LoRa terminal
Support WiFi, LoRa, and RS-485 communications
LoRa operating band: 401-510 MHz
LoRa wireless transmitting power: Max. 19±1 dBm
LoRa receiving sensitivity: -136±1 dBm (@250 bps)
Support frequency hopping of hardware (FHSS)
WiFi compatible with IEEE 802.11 b/g/n protocol, support WPA/WPA2 security mode; support Station/SoftAP/SoftAP + Station wireless network mode.

			12-bit current source output with programmable output current range of 4-20 mA, 0-20 mA or 0-24 mA and output temperature drift ±3 ppm/°C 12-bit DAC output with sampling rate up to 3.2 Msps and output voltage up to 3.3 V Pulse output (3.3 V logic level, non-isolated)		
III	Hardware	Intelligent identification kit	1. High frequency reader Protocols supported: ISO/IEC 14443 Type A Current can be supplied to the card: 0-130 mA Communication type support with PC: Low Speed USB (USB 1.1); Bus powered device; HID (USB driverless) Communication rate support: 9,600-38,400 bps Operating voltage: 5 V DC, USB powered 2. UHF desktop CPU Operating frequency: 920-925 MHz, 250 KHz hopping frequency Transmitting power: 15 dbm Protocols supported: EPC GEN2/ISO 18000-6C Identification distance: 30 cm-1 cm Write data distance: 5 cm-1 cm 3. UHF RF reader Support electronic tags compliant with ISO18000-6B and EPC CLASS1 G2 standards Operating frequency: 902-928 MHz Operating voltage: 5 V DC, power adapter powered Output power up to 26 dbm Support reading distance of 1-3 m 4. QR code scanning gun Reading accuracy: $\geq$ 3 mil Typical reading depth of field: EAN-13, 40 mm-355 mm (13 mil) Code 39, 28 mm-155 mm (5 mil) PDF 417, 28 mm-95 mm (6.67 mil) Data Matrix, 25 mm-95 mm (10 mil) QR, 25 mm-150 mm (15 mil) Bar code sensitivity: Tilt, ±60°@ 0°Roll and 0° Skew Rotation, 360°@ 0°Pitch and 0°Skew Deflection, ±55°@ 0°Roll and 0° Pitch Minimum contrast: 30% 5. Low frequency reader With a working indicator and buzzer Sensing distance: 1 cm-15 cm Baud rate support: 57,600 bps 6. Smart camera Video compression support: H.264 Main Profile @ Level 4.1/Motion JPEG Network protocol support: IPv4, TCP/IP, UDP, HTTP, RTP/RTCP/RTSP, FTP	Set	1

			With RJ45 network port		
IV	Hardware	Gateway and network equipment kit	1. IoT gateway Support Ubuntu systems. With 10/100/1,000 Mbps RJ45 Ethernet port; support 2.4 GHz WiFi connectivity, with HDMI. Support H.264, VP8 and MVC image enhancement processing. With hardware security system; support HDCP2.X; support ATECC608A chip hardware encryption. Support OpenCV machine vision libraries and TensorFlow. Support the connection to IoT cloud platforms (encrypted cipher-text communication based on SHA256, PRF, HMAC-SHA256, HKDF, ECDSA, ECDH, and AES algorithms). Southbound support for docking various IoT devices that support the Modbus protocol and can be containerized for deployment to enable data collection, device control and management. Southbound support for docking various IoT devices that support the CANbus protocol and can be containerized for deployment to receive and manage data reported by the devices autonomously. Southbound support for docking ZigBee, WiFi, LoRa and other wireless protocols and can be containerized for deployment to achieve data collection, device control and management of IoT devices accessed by various protocols. Southbound support for connecting to a serial server via Ethernet to capture and control serial devices under the serial server. Northbound connection to IoT cloud platforms, edge computing service systems and IoT applications, enabling northbound communication of data and command reception. 2. Serial server With 10/100 Mbps adaptive Ethernet port and built-in 1.5KV electromagnetic protection. Support multiple serial server cascades. At least four RS-232 interfaces and two RS-485 interfaces, and support 15 KV ESD protection. Protocols supported: ICMP, IP, TCP, UDP, DNS, DHCP, Telnet and HTTP. Support configuration via Web browser, Telnet, and Console. 3. LoRa gateway Support LoRa, WiFi, and Ethernet communications. WiFi compatible with IEEE 802.11 b/g/n protocol, with a built-in complete TCP/IP stack. Support LoRa operating band: 410-441 MHz	Set	1

			Support multiple modulation modes, LoRa/FSK/GFSK/MSK/GMSK/OOK. Ethernet with integrated hardware TCP/IP stack; support TCP, IPv4, ARP, ICMP, IGMP and PPPoE protocols. Built-in 10/100 Mbps Ethernet data link layer and physical layer. Support auto-negotiation (full/half duplex mode). Support eight independent ports (Sockets) connected simultaneously. 4. Router Support network standards: IEEE802.11a, IEEE802.11b, IEEE802.11g. 5. Switch At least eight 10/100/1,000 M adaptive RJ45 ports.		
V	Hardware	IoT installation platform	1. Equipped with three sets of mesh operating panels for deploying various IoT devices and building IoT application scenarios, with a total mesh panel area of not less than 2 M2. 2. Equipped with strong and weak power supply systems, at least ten strong power supply sockets and at least eight sets of DC weak power (commonly used 5 V, 12 V, 24 V) supply interfaces. 3. The DC weak power supply system is equipped with a short-circuit protection system. In case of DC weak power short-circuit under the same voltage, the DC weak power system of the group of voltage automatically powers off. After removing the short circuit, it can automatically restore the power supply. During the power-off period, the use of DC weak power systems of other groups of different voltage is not affected. 4. Equipped with safety distribution box with air switch and leakage protection system, one way for power input and one way for general switch control, to ensure the safe and reliable use of the system.	Set	1
VI	Software	AIoT platform	1. The AIoT platform shall contain functional modules such as a virtual simulation system, virtual machine services and an IoT application platform. 2. B/S architecture is adopted, supporting login and use on different operating systems through web browsers. 3. It supports single sign-on, and one account can complete the authentication of all systems. 4. The virtual simulation system shall have archiving (export) and reading (import) functions to support saving and reading at any time. 5. The virtual simulation system workbench	Set	1

shall support the storage and layout of virtual suites in graphical form and the addition of connection diagrams.

6. The virtual simulation system shall support the connection and detection function of simulation equipment and can turn the detection function on or off to verify the correctness of the connection.

7. The simulation sensors in the virtual simulation system support simulation data sources to generate simulation data by constant or random values.

8. The virtual simulation system shall contain various sensors, including at least: an air quality sensor, atmospheric pressure sensor, carbon dioxide sensor, temperature and humidity sensor, light sensor, oxygen sensor, PM2.5 sensor, soil moisture sensor, liquid level sensor, water temperature sensor, wind sensor, wind speed sensor, human body sensor, flame sensor, infrared antithetical sensor, microwave sensor and smoke sensor.

9. The virtual simulation system shall contain various sensing network nodes, including at least: RS-485 digital acquisition module, RS-485 analog acquisition module, ZigBee node, ZigBee coordinator and LoRa terminal.

10. The virtual simulation system shall contain various intelligent identification equipment, including at least: a low-frequency reader, high-frequency reader, UHF reader, low-frequency card, high-frequency card, and UHF card.

11. The virtual simulation system shall contain gateways and network equipment, including at least: an IoT gateway, router, and serial server.

12. The virtual simulation system shall contain various strong and weak power supplies.

13. The virtual simulation system shall contain various actuators, including at least: warning lights, lighting lamps, fans, heating, air conditioning, and water valve controllers.

14. Virtual machine services support at least one independent virtual machine for each user.

15. Users can access virtual machines via SSH terminals on the AIOT platform to complete IoT middleware configuration and deployment, as well as docker microservice configuration and deployment.

16. The application platform supports the use of HTTP, MQTT and COAP protocols to collect equipment data.

17. The application platform supports the creation of alarm events based on the collected equipment data and status information. Alarm events have a life cycle and can be cleared and confirmed. Alarm events should support at least

			five different levels.		
			18. The application platform supports the storage of time-series data in a built-in non-relation database.		
			19. The application platform supports inquiries for the latest time-series data values and all data within a specific period.		
			20. The application platform supports checking or subscribing to data updates via API and WebSocket.		
			21. The application platform can monitor the connection status of equipment and trigger equipment connections that are pushed to the rule engine.		
			22. The application platform supports server-side applications to send remote RPC calls to devices.		
			23. The application platform has a rule engine capable of receiving incoming data from devices, device life-cycle events, API events, and RPC requests, and creating rule nodes and rule chains to filter, convert and execute the incoming data.		
			24. The application platform supports the creation of custom data boards by adding digital and analog instruments, map components, device controls, charts, data cards and other components to complete the visual display of data.		
			25. The application platform supports logging functions to record user operations related to devices, rule engines and data boards.		
			26. The application platform supports MQTT certificate authentication, device identity authentication, access token authentication and other authentication methods related to information security.		
			27. The application platform supports various Node module resources, provides a browser-based procedure editor, and can assemble nodes into a procedure, which can be installed into the operation environment through one-click deployment.		
			28. The application platform supports the connection to various smart devices, including lights, switches, doors, fans, ringing bells, thermo-hygrometers, audio, security monitoring devices, and smart meters, and can centrally control the devices and track their status.		
			29. The platform shall provide C, C++ and Java programming support and provide API interfaces including MQTT, CoAP, REST and RPC.		

ii. Computer software environment

No.	Category	Device	Quantity
1	Software	Microsoft windows 10 (64-bit) trial version	1
2	Software	Ubuntu 20.04	1
3	Software	Microsoft Office 2016 (trial version)	1
4	Software	Microsoft Visio 2016 (trial version)	1
5	Software	IAR Embedded Workbench for 8051 8.10.1 (trial version)	1
6	Software	Keil uVision 5 (trial version)	1
7	Software	Android Studio 3.2	1
8	Software	Visual Studio 2015 (trial version)	1
9	Software	VS Code 1.52	1
10	Software	Python 3.6	1
11	Software	Debugging packages, network scanning, listening tools, serial debugging assistants, etc.	1

XI. Result Evaluation

The assessment of the Competition is based on the principles of fairness, impartiality and openness, and the assessment criteria focus on the values and attitudes, the ability to apply IoT technology, teamwork and communication, and the ability of organization and management of the competitors. The main focus is on innovation and operational skills, taking into account the teamwork spirit and professional ethics for comprehensive evaluation.

i. Assessment rules

The assessment methods include judgment (subjective) and measurement (objective). Separate marking teams are set up according to each module marking form, and the jury president appoints the judges of each marking team to award marks for each module. Each marking team is responsible for the on-site marking of the same indicator for all competitors and signing to confirm the marking results.

1. Judgment (subjective)

Judgement marking: Three (N) or more judges form a jury, of which judges award marks independently, and the jury calculates an average weighted score, divides it by three (N) and multiples it by the mark of the sub-item for the actual mark. The marking difference between the judges must be less than or equal to one point, otherwise, the exact reason must be given and the score must be adjusted under the supervision of the team leader or jury president.

The weight table is as follows:

Weighted score	Requirement description
0 point	Below industry standards in all areas, including "not attempted"
1 point	Meet industry standards
2 points	Meet industry standards and exceed industry standards in some aspects
3 points	Excellent level expected by the industry

(Sample: Evaluation Criteria Reference for X-zone Organized Wiring)

Weighted score	Requirement description
0 point	Not acceptable (disorganized wiring, more than one or more unfinished wiring)
1 point	Meet industry standards (ability of standardized wiring in the slot)
2 points	Meet and slightly exceed industry standards (appropriate equipment wiring and standardized wiring in the slot)
3 points	Perfect (standardized and organized wiring between equipment interfaces, easy maintenance)

2. Measurement (objective)

Measurement marking: Three or more judges form a marking team to agree on the actual marks of the competitor and give a final mark. If there are many judges, a different grouping can be determined.

Sample Table of Measurement Marking Criteria

Type	Example	Maximum mark	Correct mark	Incorrect mark
Full or zero points				
Add from zero points				

(Sample: Measurement Marking Criteria)

Type	Example	Maximum mark	Correct mark	Incorrect mark
Full or zero points	Configure the temperature and humidity sensor address	0.50	0.50	0
Add from zero points	Control the operation of each actuator via the IoT Cloud Platform.	1.0	1.0	0

ii. Judgment method

When marking modules A and B, the judges in the marking team will each have a marking form. The judges will mark the equipment installation and results saved in the USB flash disk for submission according to the criteria in the marking form. If the results to be submitted are not found in the USB flash disk, the judge may check the submission in the "D:\Submitted Information" on the computer, but will deduct one point from the submission.

When marking modules C and D, teams will take turns to present to the jury in the order of their workstation numbers. When a team is presenting, the other teams must wait outside the workstation and may not conduct any TP operations.

In principle, the presentation time for each team should not exceed ten minutes, but if a delay is indeed required, the jury president will rule on the case based on the reality.

iii. Marking method

1. Judging is carried out by the jury and the grouping and division of duties of the jury is carried out by the jury president.

2. During the judging, all judging conclusions must be decided collectively by the jury, and the same item should only be judged by the same jury to ensure consistency in the judging criteria.

3. The judging is divided into measurement and evaluation. Measurement marking: Measure and evaluate the results of the Competition, such as the design drawings, data screenshots, answer sheets and construction works of the competitors according to the rules of the Marking Form. Subjective evaluation marking: Evaluate the subjective judgment of the competitors' works and mark one of the indicators. The marks are calculated by the judges in accordance with the regulations and recorded on the competitors' Marking Forms.

iv. Tie in results

In the event of a tie, the jury will first decide the overall ranking of the competitors based on the different marking priorities of the modules, in descending order of priority: Module B > Module C > Module A > Module D. If the comparison of marking priorities still fails to distinguish the overall ranking of the competitors, the marking judges will vote on all subjective marking items (judgment) of the Competition modules of the competitors with the same ranking. The competitor with higher votes will be ranked higher.

v. Judge professional competence requirements

No.	Professional and technical directions	Requirements for knowledge and competence	Judging, teaching and work experience	Professional and technical titles (level of professional qualification)	Headcount
1	Internet	Bachelor's degree and above	Instructors with experience in judging at provincial or higher-level competitions	Intermediate title or above	12 persons
2	Electronics, communications				
3	Computer				
judges Total number of judges	12 persons				

vi. Result announcement

The jury president will submit the marking results of the workstations (competition entries) within eight hours of the end of the competition. After the results are re-checked and confirmed to be correct, the jury president, supervising personnel and arbitrators will sign for confirmation before announcement, and the announcement time is two hours. If there is no objection on the announcement, the arbitrator will sign on the marking form and announce the results. Results will be submitted simultaneously to the competition system.

XII. Awards and Prizes

One gold medal, one silver medal and one bronze medal will be awarded by the Competition to three teams respectively, and the teams in the top 50% of the overall results (other than the top three) will be awarded the winning prize.

XIII. Preliminary Plans for the Competition Venue

1. The Competition hardware and software environment and computers are stress tested before the Competition to verify normal functions. The Competition site is prepared with one to two sets of complete Competition environment and sufficient spare equipment to ensure that in case of damage not caused by the competitors, the technical support staff will replace them in time after the on-site judges have determined and the jury president has confirmed.

2. In the event of equipment power failure, faults, and other accidents during the Competition, on-site judges need to promptly confirm the situation and arrange technical support personnel to handle the problem. Moreover, they should record the details and fill in the registration form for the make-up time. After reporting to the jury president for approval, they can arrange to give additional time to the corresponding competitors to make up for the delay.

3. Each Competition station is independently powered and equipped with an uninterrupted power supply during the category, and each team uses an independent network for the Competition. If an accident happens to a team but has no impact on other teams during the Competition, the team's result will not be affected.

4. In the event of a large-scale accident and safety problem during the Competition, the identifier should report them to the Executive Committee immediately. The Executive Committee should take measures such as suspending the Competition and quickly evacuating the crowd to avoid further deterioration, and report them to the higher authorities immediately. The Competition may be suspended if there is a major safety problem, and whether to suspend the Competition shall be determined by the Executive Committee. After the incident, the Executive Committee should report the details to the higher authorities.

XIV. Safety

Competition safety is a prerequisite for the smooth running of all work of the Competition and a core issue that must be considered in the preparation and operation of the Competition. The Executive Committee shall take practical and effective measures to ensure the personal safety of competitors, judges, staff, and audience during the Competition.

i. Competition environment

1. The Executive Committee shall organize a special inspection of the workshop, accommodation places and transport before the Competition, and make explicit safety requirements. The arrangement of the venue, the equipment and facilities within the venue, should comply with the relevant national safety regulations, pandemic prevention and control

requirements. Venue simulation test shall be conducted before the Competition to identify possible problems and handle them promptly.

2. A cordon should be set up around the workshop to prevent the entry of unauthorized persons in case of accidents. The necessary labor protection should be provided for the competitors with reference to the requirements of the relevant occupational posts within the competition site. In the section with dangerous operation, the judges should take strict precautions against the wrong operation of the competitors.

3. The organizer should provide conditions to ensure the implementation of the contingency plan. Emergency plans for firefighting, medical care and pandemic prevention and control, as well as safety operating procedures for the Competition should be formulated, and first aid personnel and facilities should be provided.

4. A plan for the evacuation of people from the workshop and experience areas should be developed. Indicators and guidance staff should be installed in crowded areas such as the venue and rest areas.

5. It is strictly forbidden for competitors and judges to bring communication and photographic recording equipment or recorders into the workstations and workplaces. If necessary, it will be allocated and managed by the workshop. Security check equipment will be deployed to check the personnel entering the important parts of the venue.

ii. Living conditions

1. During the Competition, the Executive Committee will arrange the food and accommodation for the competitors uniformly. The Executive Committee shall fully take into consideration the religious beliefs and habits of the competitors and team leaders of each country or region, and arrange the food and accommodation.

2. The place of accommodation arranged during the Competition should have the business permit for hotel/accommodation.

3. Transport safety of organized visits and observation activities during the Competition is under the responsibility of the Executive Committee. The Executive Committee and the organizer shall ensure the transport safety for competitors, judges, and staff during the Competition.

4. The security management of each category, in addition to the necessary security quarantine measures that can be taken, should strictly comply with the relevant national laws and regulations to protect personal privacy and personal freedom.

iii. Emergency response

If an accident occurs during the Competition, whoever finds it should report to the Executive Committee immediately, and also take measures to avoid further deterioration. The Executive Committee of the Competition should immediately activate the preliminary plan to address the problem and report to the Executive Committee of the division. A Competition may be suspended if there is a major safety problem, and whether to suspend it should be determined by the Executive Committee of the division.

iv. Penalties

1. If a major safety event is caused by a team, the team will be disqualified from prizes.

2. Participating teams involved in major safety problems may be disqualified from continuing

the Competition if they are alerted and warned by the staff but of no avail.

3. Venue staff who violate the rules will be held accountable according to the corresponding policies. Where the circumstances are serious and cause major security incidents, the relevant parties will be held legally accountable by the judicial authorities.

XV. Competition Notice

i. Pandemic prevention and control requirements

In accordance with the pandemic prevention and control requirements, all competitors, team leaders and staff involved in the Competition on the day must provide the necessary health and travel data to the organizer. During the Competition, all relevant personnel must strictly observe the relevant pandemic prevention regulations.

All competitors should take adequate personal protection, and scientifically and reasonably wear a mask and carry a spare mask during the Competition and in enclosed public places, and those with a body temperature $\geq 37.3°C$ are not allowed to enter the venue, meeting room, restaurant and other places.

ii. Safety operating regulations

1. Competitors must confirm that the workstations, equipment and tools are safe and intact according to the regulations, strictly comply with the regulations and operating procedures of the workshop, take care of personal and equipment safety, accept the supervision and warnings of the judges and compete in a civilized manner.

2. When installing the Competition equipment, competitors should understand the performance parameters of the equipment in advance to ensure correct use of the equipment.

3. When installing sensors, competitors must pay attention to the positive and negative short circuits of the power supply to avoid burning out the equipment and causing safety accidents.

4. When installing equipment, competitors should keep the power off at the workstation and should not connect the equipment with electricity. In case of any leakage of electricity, please report it to the judge and contact the technical personnel to check the equipment.

5. When installing equipment, competitors should pay attention to anti-static safety and should not place the circuit boards on metal surfaces and unprotected stacks.

6. Competitors should not touch or open the power distribution box of the training station and pay attention to the safety of using 220V strong electricity behind the station.

7. Competitors are not allowed to enter other teams' workstations or interfere with other teams during the Competition.

iii. Notice for teams

1. Each team must purchase personal accident insurance for the competitors during the Competition.

2. Each team shall manage and educate the competitors and team leaders on safety and the team leaders shall keep their communication open during the Competition.

3. Each team shall obey and implement the arbitration results. If there are any malicious appeals, the Executive Committee will hold relevant personnel accountable after verification.

4. The team leader is responsible for the management and organization of the team during the

Competition.

iv. Notice for team leaders

1. The team leader should firmly implement the Competition rules and other rules, obey the arrangements and management of the Executive Committee, and strengthen the management of the competitors and make all preparations.

2. The team leader is responsible for drawing the team numbers and is not allowed to enter the Competition site during the Competition.

3. The team leader is responsible for the coordination and liaison between his/her team and the Executive Committee during the Competition.

4. If a team holds that there are rule violations, the team leader should submit a written appeal to the arbitration team within two hours of the end of the Competition. Oral appeals are invalid and will not be accepted by the arbitration team.

v. Notice for competitors

1. Competitors should strictly comply with the regulations and operating procedures of the workshop, ensure personal and equipment safety, accept the supervision and warnings of the judges and compete in a civilized manner.

2. Competitors should participate in the Competition with an entry certificate issued by the Executive Committee and valid documents (ID card or passport).

3. Competitors should enter the workshop within the specified time, confirm and sign for the site conditions, and operate according to the unified instructions. Each team should determine its own division of work, workflow and schedule for team competitors and complete the Competition at the designated workstations within the specified time. Competitors are not allowed to enter other teams' workstations at will.

4. After entering the workshop, competitors should confirm that the equipment and tools are safe and intact, and strictly observe the regulations and operating procedures to ensure personal and equipment safety.

5. During the Competition, if there is a fault of the Competition equipment which is not caused by the competitors, please promptly indicate to the judge on site for repair or replacement of the equipment by the technical personnel. The jury may make up the time spent on troubleshooting for the competitors as appropriate.

6. When installing and deploying the Competition equipment, competitors should understand in detail the performance parameters of the equipment, such as the power supply input, to ensure the normal use of the equipment.

7. When connecting sensors and other equipment, competitors should pay attention to preventing the positive and negative short circuits to avoid burning out the equipment. Please do not touch or open the power distribution box of the training station and pay attention to the safety of using 220 V strong electricity behind the station.

8. Food and water will be provided uniformly during the Competition. If competitors take a break, drink water, and use the restroom, these are included in the Competition time.

9. After the Competition, teams are required to clean up the workshop and restore it to pre-Competition condition.

10. During the Competition, if the competitors disobey the instructions of the judge and disturb the order of the workshop, the jury president will deduct the score of the team as appropriate; if the circumstance is serious, the competitor will be disqualified. If there is cheating, the competitor will be disqualified directly.

vi. Notice for staff

1. The workshop staff are hired by the Executive Committee and their duties are divided by the Executive Committee.

2. The staff shall obey the leadership of the Executive Committee, abide by professional ethics, adhere to the principles, act according to the rules. The staff shall perform the duties properly with a strong sense of responsibility, serious and conscientious attitude, and rigorous and meticulous style.

3. All staff should be familiar with the Competition Rules and carefully implement the rules.

4. The staff shall stick to the position, and shall not be late, leave early, or leave without permission.

5. The workshop staff shall actively maintain the order of the workshop in order to facilitate the normal performance of competitors.

6. The staff shall not answer any technical questions about the Competition raised by competitors during the Competition, and they shall report to the Executive Committee in case of controversial issues.

7. Whoever violates the rules, brings bad influence to the Competition, or causes damage will be subject to necessary management.

XVI. Appeal and Arbitration

i. Appeal

1. Competitors may file an appeal against equipment, tools and materials that do not comply with the Competition regulations, unfair monitoring and judging, as well as rule violations of staff. The team leader may submit a written appeal to the arbitration team within two hours of the end of the Competition.

2. A written appeal should give a full and factual account of the incident, time, personnel involved and the basis for the appeal, and should be signed by the team leader. Non-written appeals will not be accepted.

3. The complaining party may waive the appeal at any time.

4. The complaining party shall not disrupt the venue for any reason through drastic actions.

ii. Arbitration

1. To ensure smooth Competition and the fairness of the results, the Skill Competition arbitration team is responsible for receiving and arbitrating all appeals arising from the Competition.

2. The arbitration team will organize a review arbitration within two hours of receiving the appeal and inform the complaining party of the results of the arbitration in writing in a timely manner.

3. If the complaining party still disagrees with the review result, the team leader may submit

an appeal to the Supervisory Arbitration Committee of the division. The arbitration award of the Supervisory Arbitration Committee of the division shall be final. The competitor may not stop the Competition due to the appeal or objections to the arbitration opinion, otherwise, the competitor will be treated as forfeited.

XVII. Competition Observation

i. Public observation

The media audience can visit the Competition site in an organized manner along the designated viewing channel without disturbing the competitors and learn about the achievements of IoT technology and vocational education.

An open exhibition area will be set up outside the competition venue to publicize the application of IoT technology, and show the public the application of IoT technology in real life or future life.

Cameras are reasonably installed at the competition venue to broadcast the whole Competition live for leaders, guests, team leaders, coaches and some student representatives in the lounge.

ii. Organizational arrangements

The observing group should be led by the staff in batches to observe the Competition.

iii. Disciplinary requirements

The observing members are required to keep quiet at the site and visit in an organized manner along the designated viewing channel without entering the Competition area, touching the equipment or disturbing the competitors.

Observers are required to comply with the discipline of the workshop, and are not allowed to bring mobile phones, tablets and other communication tools into the venue, or talk or pass messages to the competitors.

XVIII. Live Competition

In order to expand the social influence of the Competition and ensure fairness, justice and openness, after the official start of the Competition is announced by the jury president, the whole process of the Competition will be video-recorded and live-streamed at each workstation. Corresponding videos will be produced through interviews with competitors and instructors, comments of judges, experts and interviews with business personnel at the opening and closing ceremony site, highlighting the skills focus and advantageous features of the Competition and providing comprehensive information materials for the promotion and resource conversion of the Competition. Videos can be submitted to the Executive Committee as a part of the competition results and historical information of the Competition for the reference of subsequent competitions. The Competition process of competitors can be converted into teaching materials to promote the teaching and learning development of relevant majors.

XIX. Resource Conversion

Under the guidance and supervision of the Executive Committee, a plan for resource conversion should be submitted to the office of the Executive Committee within 30 days after the Competition. Resource conversion should be completed within half a year. The Competition adheres to the principle of integrated design, coordinated implementation and mutual drive between the resource conversion and the preparation of the Competition,

transforming the content of the Competition into teaching and training resources, and promoting the publicity and application of the results of the Competition in the fields of professional construction of colleges and industrial talent training.

i. Materials for resource conversion

The conversion of the Competition focuses on various resources in the whole process, including but not limited to:

1. Sample TP;

2. Competition skills assessment and marking cases;

3. Competition result cases;

4. Assessment environment description;

5. Audio and video recording of the Competition process;

6. Review of judges and experts;

7. Interview with excellent competitors and experts.

ii. Implementation process of resource conversion

After the Competition, a seminar on the resource conversion and professional talent training will be held, and a plan for the resource conversion will be developed and implemented. At the same time, seminars will be organized for well-known enterprises, research institutions and colleges on all fronts such as the development of the blockchain industry, job skills, professional construction, talent training and curriculum reform to ensure that the results of the resource conversion of the Competition can be widely applied in college education.

iii. Outputs of the resource conversion

The outputs of the resource conversion include the basic resources (including the introduction of the skills of the Competition, the main points of the skills and evaluation indicators) and the education resources (including the curriculum resources, skills training guide and skills operation procedures) of the Competition, as well as the construction of a practical training case library, curriculum resources and the results of the Competition Converted resources should be uploaded to an online information release platform designated by the Competition.

Item	Task
Textbook preparation	It is proposed to cooperate with some outstanding colleges to prepare textbooks related to IoT system planning, IoT construction management, IoT system operation and maintenance, intelligent IoT application system development and sensing application technology for schools offering IoT-related majors.
Construction of education resources	A library of relevant education resources built around the aforesaid textbooks, including courseware, operation videos and assessment standards, will be available with the publication of the textbooks, providing rich education resources for schools at the application level.

Professional construction	A seminar on professional construction will be hold to revise the construction of a professional curriculum library for IoT-related majors of higher vocational colleges according to the development of the industry, clarify the professional core curriculum, compile curriculum standards, and provide curriculum guidance for higher vocational colleges to build IoT majors.
Seminar on the results of the Competition	The instructors or students of domestic and international teams will be invited to introduce the results of the Competition, including the information text, audio and video, and picture results of the Competition. They will exchange their learning experiences around the results of the IoT Competition, discuss in groups and put forward practices and suggestions for further in-depth research. The results of the Competition will be influential and effectively promoted and applied in schools.
Build a model of "integration of position-course and competition-certificate"	Relying on the background of the IoT industry and the cooperation basis with the colleges and universities, the Competition will explore the talent training model of 1+X+Y based on the position-course and competition-certificate, realize the "docking of professional setting with industrial demand, curriculum content with vocational standards, teaching process with production process, and integrate the content of the Competition into the curriculum to lead the education reform, cultivate high-quality and highly skilled talent in line with social development and industry needs.
University-enterprise cooperation	Strengthen cooperation with enterprises to bring the results of the Competition closer to the industry. Focus on the transformation of the results of the Competition into industry, apply the results of the Competition in industries and transform them into practical IoT application projects that can be implemented in actual engineering cases, so as to generate direct economic and social effects.
International cooperation	Relying on the "Belt and Road Initiative", more students from countries along the Belt and Road will be invited to participate in the Competition while aligning with the international education system and fully integrating more foreign education standards, so as to effectively promote the international development of China's IoT field, and further help countries along the Belt and Road to train high-quality IoT industry-related vocational talent.

XX. Miscellaneous

1. Any work of the Competition should not damage the surroundings of the venue

2. The Green concept should be promoted, and all recyclable materials should be sorted and

collected