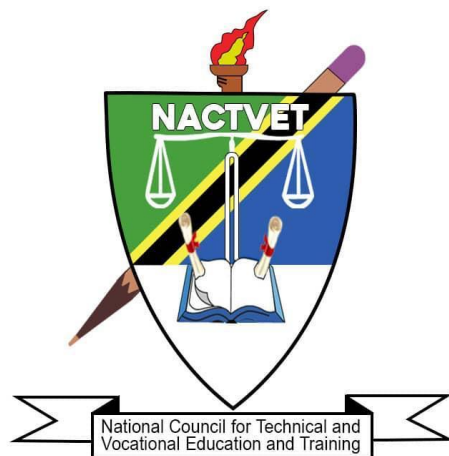


**NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND
TRAINING**



SEPTEMBER 2023

PROPOSED OCCUPATIONAL STANDARDS

OCCUPATION: INTELLIGENT AGRICULTURE ENGINEER

LEVEL: NTA 8

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ABBREVIATIONS

CAD	Computer-aided Design
CBET	Competency Based Education and Training
CNN	Convolutional Neural Network
ICT	Information and Communications Technology
IoT	Internet of Things
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
PLC	Programmable Logic Controller
RNN	Recurrent Neural Network
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training

GLOSSARY OF TERMS

Circumstantial Knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.
Competence:	The ability to use knowledge, understanding, practical, and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based Education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training Programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks - essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational Area:	This is a broad grouping of related jobs. (Example: intelligent agricultural system maintenance)
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.

Standards:	A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.
Task Analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that it meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupational Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current and consistent in delivery across all public and private institutions.

However, it must be noted that, Occupational Standards and Training Standards/Qualifications Standards are different. Occupational Standards are defined in terms of activities performed by a person in a selected occupation (e.g., an intelligent agriculture engineer designs systems, performs sensor network troubleshooting, etc.) and they are usually defined by employers following procedures agreed upon by all stakeholders. Education and Training standards are developed from the activities defined in occupational standards, and they include learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him or her to function at an agreed level in an occupation. Education and Training standards are used to define curricula in training institutions. It is however critical that there must be a direct link between the Occupational Standards and the training standards to respond to demands of the labour market.

In TET delivery, Tanzania adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the Occupational Standards. Occupational Standards are thus the starting point for developing competency-based training (CBET) programmes. TET institutions will be required to benchmark their curricula with relevant Occupational Standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Intelligent Agriculture Engineer Occupation has its own set of occupational standards. The document explains how the Occupational Standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational Standards development process began with an examination of major documents that guide Tanzanian skill development. The *10-year National Skills Development Strategy (2016-2026)* was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and Logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The Occupational Standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the Occupational Standards. Engineers, supervisory technicians on the job, and experienced Intelligent Agriculture Engineers were key informants in the survey to discover occupational trends. The information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of ... online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they also served to engage a wide cross-section of experts in the occupation. Apart from this, the stakeholders' forum was attended by ... participants from different parts of the country representing various companies.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR INTELLIGENT AGRICULTURE ENGINEERS

The standards cover a broad range of duties and tasks that can be performed by an Intelligent Agriculture Engineer. However, the occupational standards are not meant to replace individual job

descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Intelligent Agriculture Engineer may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Intelligent Agriculture Engineers shall be professionals of technology and agriculture backgrounds and can use intelligent technology and data analysis and other means to improve agricultural production efficiency, farmland management and resource utilization efficiency, and design, develop and implement intelligent agricultural systems. They are required to understand the principles of agricultural production and are capable of system design and project management. They can also solve problems in the implementation of intelligent agriculture, and communicate and collaborate effectively with farmers, leaders and technical teams to drive the development and application of intelligent agriculture. Generally, the Intelligent Agriculture Engineer performs the following responsibilities:

- a) Intelligent agriculture sensor network design
- b) Installation and debugging of intelligent agriculture sensor network infrastructure
- c) Detection, operation and maintenance of intelligent agriculture sensor network
- d) Management and redevelopment of intelligent agriculture sensor network
- e) Artificial intelligence applications in intelligent agriculture sensor network
- f) Intelligent agriculture sustainability and resource management
- g) intelligent agriculture marketing and training

The Occupational standards have been clustered into NTA qualification levels i.e. NTA level 7 and 8.

4.0. VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR INTELLIGENT AGRICULTURE ENGINEER - NTA 8

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SENSOR NETWORK DESIGN	DUTY NO.	801
TASK TITLE	FIELD MONITORING OF INTELLIGENT AGRICULTURE DATA	TASK NO.	8011
PERFORMANCE CRITERIA	The person performing this task must be able to use testing tools and equipment to detect and determine the system performance according to the actual situation of the intelligent agriculture sensor network system.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Printers; 2. Computers; 3. Programming and data analysis software; 4. UAVs and remote sensing equipment; 5. Sensors.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions; 2. Carry out field survey according to the actual situation of the area where agriculture is located in the municipal planning drawings; 3. Adjust the monitoring plan and parameters according to actual needs, and optimize the data acquisition process; 4. Gain proficiency in the operation and maintenance of sensors and monitoring equipment, and ensure data acquisition accuracy and stability; 5. Scientifically analyse and process the acquired data to deliver suggestions and plans that are beneficial for guiding agricultural production, timely organize and produce reports on monitoring data, providing effective decision-making basis for decision-makers.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use various sensors to manipulate UAVs and other remote sensing equipment, and to sample the environment, soil, crops, etc.; 1.2 Accurately analyse the acquired data to get valuable information; 1.3 Determine monitoring parameters and scope according to the needs and actual scenarios of agricultural production. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Data acquisition and transmission for field monitoring of intelligent agriculture data; 2.2 Data processing and analysis for field monitoring of intelligent agriculture data. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic agricultural knowledge;	

	3.2 Meteorological knowledge; 3.3 Knowledge of sensors and communication technology; 3.4 Knowledge of data processing and analysis methods; 3.5 Knowledge of computer and network technology; 3.6 Knowledge of agricultural information technology; 3.7 Project management. 4.0 Essential Skills 4.1 Technological innovation and learning skills; 4.2 Teamwork and communication skills; 4.3 Experimental design and data analysis skills; 4.4 Security and privacy awareness; 4.5 Environmental adaptability.
DESCRIPTION OF THE END PRODUCT / SERVICE	Testing tools and equipment are used to detect and determine the system performance according to the actual situation of the intelligent agriculture sensor network system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National, local, and industry codes; 2. Agricultural informatization standard system; 3. Agricultural IoT technology for protected agriculture applications; 4. General requirements for urban agricultural park; 5. General requirements for creative agricultural park; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SENSOR NETWORK DESIGN	DUTY NO.	801
TASK TITLE	IDENTIFICATION AND SELECTION OF INTELLIGENT AGRICULTURAL SENSING DEVICES	TASK NO.	8012
PERFORMANCE CRITERIA	The person performing this task must be able to complete the selection of intelligent agricultural sensing devices in line with local conditions.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Multimeters, oscilloscopes, signal generators, spectrum analysers, etc.; 2. Computers; 3. Network analysers, protocol analysers, port scanners, etc.; 4. Sensor configuration software, gateway configuration software, etc.; 5. Sensors; 6. Data analysis software; 7. Thermometers, hygrometers, illuminometers, etc.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Identify and evaluate the performance and applicability of different sensing devices; 2. Select appropriate sensing devices to meet project requirements and performance standards; 3. Ensure compatibility and interoperability between selected sensing devices; 4. Write a sensing device selection report and record the selection process and results; 5. Ensure data security and privacy, and continuously track and evaluate the effectiveness of sensing devices to improve user satisfaction.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Conduct technical assessments; 1.2 Conduct cost-benefit analyses; 1.3 Conduct experimental verifications; 1.4 Record information regarding the selection process, results, and decision-making basis. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of identifying and selecting intelligent agricultural sensing devices; 2.2 Identification and selection of intelligent agricultural sensing devices. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic agricultural knowledge; 3.2 Knowledge of sensor technology; 3.3 Data processing and analysis methods;	

	3.4 Knowledge of wireless communication technology; 3.5 Basic knowledge of software development and programming; 3.6 Knowledge of agricultural information technology; 3.7 Basic principles and methods of project management. 4.0 Essential Skills 4.1 Project management skills; 4.2 Market research and analysis skills; 4.3 Teamwork and communication skills; 4.4 Data analysis and processing skills; 4.5 Technological innovation and learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Testing tools and equipment are used to detect and determine the device performance according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National, local, and industry codes; 2. Agricultural informatization standard system; 3. Agricultural IoT technology for protected agriculture applications; 4. General requirements for urban agricultural park; 5. General requirements for creative agricultural park; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SENSOR NETWORK DESIGN	DUTY NO.	801
TASK TITLE	INTELLIGENT AGRICULTURAL SYSTEM DESIGN	TASK NO.	8013
PERFORMANCE CRITERIA	The person performing this task must be able to design an intelligent agriculture sensor network that is efficient and stable in data acquisition and processing and offers a good user experience in line with local conditions.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Various software tools such as modeling software, programming software, and testing software; 2. Various hardware devices such as high-performance computers, sensors, cameras, RFID readers and writers; 3. Various network devices such as routers, switches, and gateways; 4. Database tools such as relational databases and non-relational databases; 5. Data mining tools, statistical analysis software, and other analysis software.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Conduct refined user requirement analysis to define and plan the objectives and functions of the intelligent agricultural system; 2. Innovatively design the architecture and components of the intelligent agricultural system; 3. Carry out rigorous system security design; 4. Design and implement advanced algorithms to process and analyse acquired sensor data; 5. Write high-quality system technical documents and user manuals.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Design software and hardware; 1.2 Plan and design the network; 1.3 Conduct simulation and testing; 1.4 Record the design ideas, methods, results, and other information. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of designing intelligent agricultural systems; 2.2 Intelligent agricultural system design. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic agricultural knowledge;	

	3.2 Knowledge of electronic and computer technology; 3.3 Knowledge of software platform and application development; 3.4 Knowledge of network and system security; 3.5 Knowledge of data processing and analysis; 3.6 Security knowledge; 3.7 Knowledge of system development lifecycle management. 4.0 Essential Skills 4.1 Software development and programming skills; 4.2 Technical analysis and problem-solving skills; 4.3 Data processing and analysis skills; 4.4 Hardware device maintenance and repair skills; 4.5 Project management skills; 4.6 Communication and teamwork skills; 4.7 Learning and innovation skills; 4.8 Device testing and calibration skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The design and optimization of the system are performed according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National, local, and industry codes; 2. Agricultural informatization standard system; 3. Agricultural IoT technology for protected agriculture applications; 4. General requirements for urban agricultural park; 5. General requirements for creative agricultural park; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INSTALLATION AND DEBUGGING OF INTELLIGENT AGRICULTURE SENSOR NETWORK INFRASTRUCTURE	DUTY NO.	802
TASK TITLE	INSTALLATION OF INTELLIGENT AGRICULTURAL SYSTEM DEVICES	TASK NO.	8021
PERFORMANCE CRITERIA	The person performing this task must be able to quickly install and configure various sensors and devices to ensure system stability and data accuracy.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Installation tools such as screwdrivers, pliers, and wrenches; 2. Software and hardware debugging tools such as network analysers, signal generators, and oscilloscopes; 3. Testing software, emulators, and other testing tools; 4. Protective equipment such as safety gloves and safety shoes.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Accurately install devices and ensure their stability; 2. Strictly observe the installation process and specifications; 3. Efficiently debug devices and ensure that their performance meets standards; 4. Optimize device layout and configuration; 5. Ensure device safety and reliability; 6. Write the device installation report and document; 7. Continuously track and evaluate the device operation status.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Configure software devices; 1.2 Test device functions; 1.3 Optimize device performance; 1.4 Share the experience and methods for documenting the installation process and results. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of installing intelligent agricultural system devices; 2.2 Installation of intelligent agricultural system devices. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic agricultural knowledge; 3.2 Basic electronic knowledge; 3.3 Knowledge of embedded systems; 3.4 Basic principles and technologies of network communication;	

	3.5 Basic knowledge of computer network; 3.6 Data security and privacy protection; 3.7 Knowledge of sensors and devices; 3.8 Intelligent agricultural system installation process. 4.0 Essential Skills 4.1 Hardware installation and debugging skills; 4.2 Technical analysis and problem-solving skills; 4.3 Programming and data processing skills; 4.4 System maintenance and troubleshooting skills; 4.5 Network configuration and management skills; 4.6 Communication and teamwork skills; 4.7 Problem-solving and troubleshooting skills; 4.8 Learning and updating skills; 4.9 Document writing and reporting skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation and debugging of the system device are performed according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National, local, and industry codes; 2. Agricultural informatization standard system; 3. Agricultural intelligent technology for protected agriculture applications; 4. Agricultural IoT codes; 5. Building and engineering construction codes; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Agricultural park requirements; 8. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INSTALLATION AND DEBUGGING OF INTELLIGENT AGRICULTURE SENSOR NETWORK INFRASTRUCTURE	DUTY NO.	802
TASK TITLE	INSTALLATION OF INTELLIGENT AGRICULTURAL SYSTEM NETWORK	TASK NO.	8022
PERFORMANCE CRITERIA	The person performing this task must be able to quickly install and configure the intelligent agricultural system network, ensure its stability and availability, and improve the operational efficiency and user experience of intelligent agriculture.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Routers, switches, gateways, network cables, RJ connectors, and other network devices; 2. Network analysers, ping, and other network testing tools; 3. Servers, disk arrays, and other server and storage devices; 4. Firewalls, intrusion detection systems, and other network security devices; 5. Computers.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Install network devices and components; 2. Configure network device parameters; 3. Ensure network security and optimize network performance; 4. Test network connectivity and performance; 5. Write the network installation report and document; 6. Continuously track and evaluate the network operation status.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Configure network parameters; 1.2 Test network connectivity; 1.3 Optimize network performance; 1.4 Ensure network security. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of installing intelligent agricultural system network; 2.2 Installation of intelligent agricultural system network. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic agricultural knowledge; 3.2 Basic knowledge of computer network;	

	3.3 Basic knowledge of communication technology; 3.4 Basic knowledge of network security; 3.5 Knowledge of data processing and analysis; 3.6 Intelligent agriculture network installation process. 4.0 Essential Skills 4.1 Network planning and design skills; 4.2 Network device installation and debugging skills; 4.3 Data transmission and storage skills; 4.4 Troubleshooting and maintenance skills; 4.5 Network maintenance and optimization skills; 4.6 Communication and teamwork skills; 4.7 Learning and innovation skills; 4.8 Document writing and reporting skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The installation and debugging of the system network are performed according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National, local, and industry codes; 2. Agricultural informatization standard system; 3. Agricultural IoT and big data technologies for protected agriculture applications; 4. Agricultural IoT codes; 5. Building and engineering construction codes; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety; 8. Network protocol specifications and network security; 9. Agricultural park requirements.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INSTALLATION AND DEBUGGING OF INTELLIGENT AGRICULTURE SENSOR NETWORK INFRASTRUCTURE	DUTY NO.	802
TASK TITLE	DEBUGGING OF INTELLIGENT AGRICULTURAL SYSTEM	TASK NO.	8023
PERFORMANCE CRITERIA	The person performing this task must be able to efficiently solve software and hardware problems, accurately verify data, promptly respond to and repair system failures, and improve the operational efficiency and user experience of intelligent agriculture.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. System software, application software, and other debugging software; 2. Testing software, emulators, and other testing tools; 3. Data mining tools, statistical analysis software, and other data analysis software; 4. Computers.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Test system functions and performance; 2. Diagnose and resolve system failures; 3. Optimize system performance; 4. Ensure system security and stability; 5. Write the system debugging report and document; 6. Continuously track and evaluate the system operation status to improve user satisfaction.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Conduct module and integration testing; 1.2 Conduct simulation testing; 1.3 Conduct troubleshooting and optimization; 1.4 Share the experience and methods for documenting debugging process and results. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of debugging intelligent agricultural systems; 2.2 Debugging of intelligent agricultural system. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Knowledge of software platforms and applications; 3.2 Network communication technology; 3.3 Knowledge of data processing and analysis; 3.4 Intelligent agricultural system debugging process.	

	4.0 Essential Skills 4.1 Skills in using debugging tools; 4.2 Technical analysis and problem-solving skills; 4.3 Programming skills; 4.4 System maintenance and optimization skills; 4.5 Agricultural knowledge application skills; 4.6 Communication and teamwork skills; 4.7 Learning and innovation skills; 4.8 Document writing and reporting skills; 4.9 Debugging and troubleshooting skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Troubleshooting and fault handling are performed according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National, local, and industry codes; 2. Agricultural informatization standard system; 3. Agricultural IoT and big data technologies for protected agriculture applications; 4. Agricultural IoT codes; 5. Building and engineering construction codes; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety; 8. Network protocol specifications and network security; 9. Agricultural park requirements.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	DETECTION, OPERATION AND MAINTENANCE OF INTELLIGENT AGRICULTURE SENSOR NETWORK	DUTY NO.	803
TASK TITLE	DETECTION OF INTELLIGENT AGRICULTURAL SYSTEM	TASK NO.	8031
PERFORMANCE CRITERIA	The person performing this task must be able to use special instruments to complete wired and wireless network performance testing, test the intelligent agricultural system, conduct testing analysis, complete the test report, and write solutions based on the results of the test report.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Sensors and measuring instruments; 2. Data acquisition equipment; 3. Cloud computing platforms.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Select appropriate testing tools and equipment for the task; 3. Conduct data acquisition and monitoring; 4. Conduct early warning and monitoring; 5. Conduct data analysis and decision-making support.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use testing tools and equipment to detect and diagnose system software faults; 1.2 Use testing tools and equipment to detect and diagnose device faults; 1.3 Use testing tools and equipment to detect and diagnose network faults. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of detecting intelligent agricultural systems; 2.2 Intelligent agricultural system detection and data analysis. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Agricultural knowledge; 3.2 Meteorological knowledge; 3.3 Data acquisition and monitoring technology; 3.4 Data analysis and statistical methods;	

	3.5 Information technology knowledge; 3.6 Intelligent agricultural system detection and data analysis process. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Data analysis skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Testing tools and equipment are used to detect and determine the system performance according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National or industry standards; 2. Sensor network technology for protected agriculture applications; 3. General requirements for urban agricultural park; 4. General requirements for creative agricultural park; 5. Guideline for the development and construction of multifunctional characteristic agriculture; 6. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	DETECTION, OPERATION AND MAINTENANCE OF INTELLIGENT AGRICULTURE SENSOR NETWORK	DUTY NO.	803
TASK TITLE	OPERATION AND MAINTENANCE OF INTELLIGENT AGRICULTURAL SYSTEM	TASK NO.	8032
PERFORMANCE CRITERIA	The person performing this task must be able to maintain the hardware devices of the intelligent agricultural system, manage the system software, manage and analyse the data of the IoT system, troubleshoot and repair failures in the intelligent agricultural system, upgrade and improve the system, and write daily operation and maintenance specifications and manuals.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Computers and mobile devices; 2. Communication devices; 3. Data storage devices; 4. Charging equipment; 5. Data analysis software; 6. Maintenance record tools; 7. Screwdrivers, wrenches, batteries, wires, and other maintenance tools; 8. Firewalls, anti-virus software, and other security devices.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Ensure stability and improved performance of the intelligent agricultural system; 2. Ensure a high efficiency in handling and resolving system failures; 3. Use data analysis tools and algorithms to identify potential problems and improvement opportunities, and propose solutions accordingly; 4. Ensure data security and privacy to improve user satisfaction.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Run and troubleshoot the system; 1.2 Use data analysis tools to analyse device operation and maintenance data; 1.3 Configure devices remotely using cloud platform tools; 1.4 Write daily operation and maintenance documents. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of operating and maintaining intelligent agricultural systems; 2.2 Operation and maintenance of intelligent agricultural system.	

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Agricultural knowledge; 3.2 Knowledge of sensor technology; 3.3 Data analysis and processing methods; 3.4 Knowledge of wireless communication technology; 3.5 Basic knowledge of software development and programming; 3.6 Basic concepts and methods of network security; 3.7 Basic principles and methods of project management. 4.0 Essential Skills 4.1 Communication and collaboration skills; 4.2 Electronic and sensor technology skills; 4.3 Software development and programming skills; 4.4 Data analysis and processing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Testing tools and equipment are used to detect and determine the system performance according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National or industry standards; 2. Electronic and sensor technologies for protected agriculture applications; 3. Network communication technology; 4. General requirements for urban agricultural park; 5. General requirements for creative agricultural park; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	DETECTION, OPERATION AND MAINTENANCE OF INTELLIGENT AGRICULTURE SENSOR NETWORK	DUTY NO.	803
TASK TITLE	INTELLIGENT AGRICULTURAL SYSTEM FAILURE HANDLING	TASK NO.	8033
PERFORMANCE CRITERIA	The person performing this task must be able to detect and troubleshoot failures in the intelligent agricultural system, replace faulty devices, and use various safety protection tools to protect the system.		
RANGE STATEMENT	The task can be performed within the intelligent agricultural park under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Multi-purpose testers, voltmeters, ammeters, and other fault diagnosis tools; 2. Computers, data processing software, and databases; 3. Communication devices; 4. Data backup devices; 5. Maintenance logs and fault record forms; 6. Screwdrivers, wrenches, pliers, and other commonly-used maintenance tools; 7. Firewalls, anti-virus software, and other security devices; 8. Safety helmets, gloves, protective goggles, and other personal protective equipment.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Quickly respond to failures in the intelligent agricultural system; 2. Quickly identify the cause of failures in the intelligent agricultural system; 3. Ensure timely handling of failures in the intelligent agricultural system; 4. Improve user satisfaction with failure handling.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Handle failures and troubleshoot them; 1.2 Conduct data recovery and backup; 1.3 Conduct failure prevention and optimization; 1.4 Record and share failure handling experience and methods. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of intelligent agricultural system failure handling; 2.2 Intelligent agricultural system failure handling process and troubleshooting. 3.0 Theories	

	The person performing this task must be able to explain the following: 3.1 Basic knowledge of agricultural systems; 3.2 Knowledge of hardware devices; 3.3 Knowledge of software platforms and applications; 3.4 Basic principles and technologies of network communication; 3.5 Knowledge of data processing and analysis; 3.6 Intelligent agricultural system failure handling and troubleshooting process. 4.0 Essential Skills 4.1 Failure troubleshooting and locating skills; 4.2 Technical analysis and problem-solving skills; 4.3 Data processing and analysis skills; 4.4 Hardware device maintenance and repair skills; 4.5 Network maintenance and optimization skills; 4.6 Communication and teamwork skills; 4.7 Learning and updating skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Troubleshooting and fault handling are performed according to the actual situation of the intelligent agricultural system.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. National or industry standards; 2. Electronic, sensor and network communication technologies for protected agriculture applications; 3. Network protocol specifications and network security; 4. General requirements for urban agricultural park; 5. General requirements for creative agricultural park; 6. Guideline for the development and construction of multifunctional characteristic agriculture; 7. Occupational health and safety.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	SECONDARY DEVELOPMENT OF INTELLIGENT AGRICULTURAL MANAGEMENT SYSTEM	DUTY NO.	804
TASK TITLE	PROJECT CONSTRUCTION MANAGEMENT	TASK NO.	8041
PERFORMANCE CRITERIA	The person performing this task must be able to conduct feasibility studies on the project in a progressive manner, predict and evaluate benefits, and write a feasibility study report according to project requirements.		
RANGE STATEMENT	The task can be performed at the project construction site under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Data acquisition units and sensors; 2. Servers and storages; 3. Intelligent agricultural software platforms and other auxiliary applications.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Analyse project requirements; 3. Write a feasibility report; 4. Analyse the project risk; 5. Plan risk response programs; 6. Collect records of the project information; 7. Organize and prepare for the project; 8. Develop a governance plan.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Describe information about the project requirements; 1.2 Conduct feasibility studies on the project; 1.3 Write a project feasibility report. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of project requirement analysis; 2.2 Importance of risk analysis; 2.3 Basic principles for making project plans; 2.4 Basic principles of project management; 2.5 Basic principles of project cost control; 2.6 Basic specifications for making project plans; 2.7 Basic principles of project cycle division. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Project requirement analysis process; 3.2 Project management methods;	

	3.3 Specific content of project organization and preparation. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management; 4.6 Independent thinking skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Feasibility studies are conducted on the project in a progressive manner, quantitative risk analysis is implemented, and risk response programs are planned according to project requirements.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Occupational health and safety; 2. Implementation standards for project management; 3. Basic principles and industry standards of project cycle division; 4. National or industry standards; 5. Basic provisions on risk control.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	SECONDARY DEVELOPMENT OF INTELLIGENT AGRICULTURAL MANAGEMENT SYSTEM	DUTY NO.	804
TASK TITLE	DEVELOPMENT OF INTELLIGENT AGRICULTURAL SENSORS AND DATA ACQUISITION UNITS	TASK NO.	8042
PERFORMANCE CRITERIA	The person performing this task must be able to display acquired data, the historical curve and various types of graphics of sensor data, and implement gateway device management and sensor alarm through coding.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Data acquisition units and sensors; 2. Servers and storages; 3. Intelligent agricultural software platforms and other auxiliary applications.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Create a data acquisition environment for IoT-based intelligent agricultural sensors; 2. Display acquired data through coding; 3. Analyse project requirements; 4. Display the historical curve of sensor data through coding; 5. Implement gateway device management through coding; 6. Display various types of graphics of sensor data through coding; 7. Analyse sensor data; 8. Manage gateway devices.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Create a data acquisition environment; 1.2 Display acquired data; 1.3 Evaluate the feasibility of data acquisition methods; 1.4 Write a feasibility report for data acquisition. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Accuracy and integrity of data acquisition; 2.2 Security and privacy of data acquisition; 2.3 Real-time performance and timeliness of data acquisition; 2.4 Basic principles for developing data acquisition plans. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Methods for implementing sensor alarm; 3.2 Management specifications for data acquisition;	

	3.3 Differences between various types of encoders. 4.0 Essential Skills 4.1 Programming skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management; 4.6 Independent thinking skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	A data acquisition environment is created for IoT-based intelligent agricultural sensors, the acquired data, the historical curve and various types of graphics of sensor data are displayed, and gateway device management and sensor alarm are implemented through coding.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Occupational health and safety; 2. Programming implementation standards; 3. Basic principles and industry standards of data acquisition; 4. National or industry standards; 5. Basic provisions on risk control.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	SECONDARY DEVELOPMENT OF INTELLIGENT AGRICULTURAL MANAGEMENT SYSTEM	DUTY NO.	804
TASK TITLE	MONITORING OF CLOUD PLATFORM DATA ACQUISITION, PROCESSING AND DEVELOPMENT	TASK NO.	8043
PERFORMANCE CRITERIA	The person performing this task must be able to implement video monitoring, data monitoring, and data alarm of the cloud platform through coding, with background music and broadcast control functions available.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Data acquisition units and sensors; 2. Servers and storages; 3. Intelligent agricultural software platforms and other auxiliary applications.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Implement the video monitoring of the cloud platform through coding; 3. Conduct corresponding data acquisition for the project; 4. Implement the data monitoring of the cloud platform through coding; 5. Implement cloud platform data alarm through coding; 6. Implement background music and broadcast control through coding; 7. Carry out data storage; 8. Reasonably analyse data.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Describe information about the cloud platform requirements; 1.2 Conduct a feasibility study on the implementation of functions; 1.3 Evaluate the feasibility benefits of the cloud platform; 1.4 Write a feasibility report for the cloud platform. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Importance of video monitoring of cloud platform; 2.2 Importance of risk analysis; 2.3 Basic principles for making platform development plans; 2.5 Basic principles of development cost control; 2.6 Basic specifications for making platform plans; 2.7 Basic principles of data monitoring of the cloud platform. 3.0 Theories The person performing this task must be able to explain	

	the following: 3.1 Visual development methods; 3.2 Measures against sudden failure; 3.3 Management specifications for data processing and acquisition; 3.4 Normative criteria for data monitoring. 4.0 Essential Skills 4.1 Learning skills; 4.2 Programming skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management; 4.6 Independent thinking skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The video monitoring, data monitoring, and data alarm of the cloud platform are implemented through coding, with background music and broadcast control functions available.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Occupational health and safety; 2. Implementation standards for project development; 3. Basic principles and industry standards of software development; 4. National or industry standards; 5. Basic provisions on data acquisition.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	APPLICATION OF INTELLIGENT AGRICULTURE SENSOR NETWORK TECHNOLOGY	DUTY NO.	805
TASK TITLE	AUTOMATIC IDENTIFICATION OF CROP DISEASES AND INSECT PESTS	TASK NO.	8051
PERFORMANCE CRITERIA	The person performing this task must be able to design an intelligent agricultural sensing system that is accurate, fast, real-time, scalable and user-friendly in line with local conditions, to reduce the losses caused by diseases and insect pests to crop yield and quality, thereby improving the economic efficiency of agricultural production.		
RANGE STATEMENT	The task can be performed within intelligent agricultural facilities under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Intelligent identification devices (e.g. cameras, UAVs, etc.); 2. Sensor network devices (e.g. soil sensors, meteorological sensors, etc.); 3. Data analysis software (e.g. Python, R, etc.).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
1. Ensure the accuracy of the system; 2. Ensure that the system can process at least 10 images or 100 pieces of data per second, enabling rapid monitoring and identification of crop diseases and insect pests; 3. Ensure that the system can monitor crop growth in real time; 4. Ensure that the system has good scalability; 5. Ensure that the system interface is concise and clear; 6. Take timely and appropriate control measures by automatically identifying crop diseases and insect pests.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Extract features related to diseases and insect pests by processing and analysing the acquired crop images; 1.2 Train and learn the extracted features using machine learning algorithms to build a disease and insect pest classification model; 1.3 Use a deep neural network model for higher-level feature extraction and classification of images. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Image segmentation; 2.2 Pattern recognition. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Image processing; 3.2 Machine learning; 3.3 Deep learning.	

	4.0 Essential Skills 4.1 Programming skills; 4.2 Data analysis skills. 5.0 Math Skills 5.1 Linear algebra; 5.2 Probability theory and statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Quick and accurate identification of crop diseases and insect pests is done for farms and agricultural professionals, with prevention suggestions provided accordingly.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Data collection and annotation; 2. Types and characteristics of common diseases and insect pests; 3. Prevention suggestions and guidance.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	APPLICATION OF INTELLIGENT AGRICULTURE SENSOR NETWORK TECHNOLOGY	DUTY NO.	805
TASK TITLE	INTELLIGENT IDENTIFICATION OF THE PHYSIOLOGICAL STATE OF CROPS	TASK NO.	8052
PERFORMANCE CRITERIA	The person performing this task must be able to design a system that accurately identifies the physiological state of crops in line with local conditions.		
RANGE STATEMENT	The task can be performed within intelligent agricultural facilities under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Intelligent identification devices (e.g. cameras, UAVs, etc.); 2. Sensor network devices (e.g. soil sensors, meteorological sensors, etc.); 3. Data analysis software (e.g. Python, R, etc.).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
1. Improve the accuracy of identifying the physiological state of crops using intelligent systems; 2. Monitor and provide feedback on the physiological state of crops in real time, timely detect abnormal situations and take corresponding measures; 3. Accurately identify the physiological state of crops; 4. Develop reasonable planting plans and management strategies.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Acquire relevant data in the crop growth environment using various sensors (e.g. soil moisture sensors, temperature sensors, light sensors, etc.); 1.2 Analyse and extract the morphological characteristics of crops through computer vision and image processing algorithms; 1.3 Obtain information about the reflectance, transmission, or emission spectra of crop leaves using visible light, infrared spectrum and other technologies; 1.4 Perform pattern recognition and prediction on the acquired data using algorithms such as supervised learning, unsupervised learning, or reinforcement learning. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Plant physiology; 2.2 Data acquisition; 2.3 Data processing; 2.4 Model building.	

	3.0 Theories The person performing this task must be able to explain the following: 3.1 Machine learning; 3.2 Deep learning; 3.3 Signal processing. 4.0 Essential Skills 4.1 Programming skills; 4.2 Data processing and analysis skills; 4.3 Modeling skills. 5.0 Math Skills 5.1 Probability theory; 5.2 Statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	The physiological state of crops is accurately identified and monitored, the crop growth is timely learned, and corresponding management measures for improved agricultural production efficiency and quality.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Plant physiology; 2. Sensor technology; 3. Agricultural management; 4. Software development and system integration; 5. User interface design.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	APPLICATION OF INTELLIGENT AGRICULTURE SENSOR NETWORK TECHNOLOGY	DUTY NO.	805
TASK TITLE	FRUIT RECOGNITION	TASK NO.	8053
PERFORMANCE CRITERIA	The person performing this task must be able to design a system that accurately recognizes different types of fruits in line with local conditions.		
RANGE STATEMENT	The task can be performed within intelligent agricultural facilities under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Intelligent identification devices (e.g. cameras, UAVs, etc.); 2. Sensor network devices (e.g. soil sensors, meteorological sensors, etc.); 3. Data analysis software (e.g. Python, R, etc.).		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
1. Accurately distinguish different types of fruits using fruit recognition technologies; 2. Monitor and manage orchards using fruit recognition technologies; 3. Implement automatic sorting and grading of fruits, increase production efficiency and reduce labor costs; 4. Develop reasonable planting plans and management strategies.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Categorize and recognize fruits using image processing and feature extraction techniques and in combination with machine learning algorithms (e.g. support vector machine, random forest, etc.); 1.2 Automatically recognize different fruits by training annotated mass fruit image data using convolutional neural network (CNN) and other deep neutral network models. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Feature extraction; 2.2 Classifier design; 2.3 Accuracy; 2.4 Dataset representativeness. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Image processing; 3.2 Machine learning; 3.3 Deep learning. 4.0 Essential Skills	

	4.1 Programming skills; 4.2 Data processing and analysis skills; 4.3 Problem-solving skills. 5.0 Math Skills 5.1 Linear algebra; 5.2 Probability theory and statistics.
DESCRIPTION OF THE END PRODUCT / SERVICE	Fruits are recognized in an accurate and quick manner using the fruit recognition system based on image recognition technology to improve the efficiency of fruit sales and sorting.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Computer vision; 2. Model evaluation.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SUSTAINABILITY AND RESOURCE MANAGEMENT	DUTY NO.	806
TASK TITLE	WATER-SAVING TECHNOLOGY	TASK NO.	8061
PERFORMANCE CRITERIA	The person performing this task must be able to employ advanced hydraulic engineering technology and suitable water management methods, fully raise the efficiency and effectiveness of water use in agriculture, and implement an efficient and water-saving intelligent agriculture system that is characterized by high yield, high efficiency, high quality, water conservation, and low consumption for sustainable development.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Soil temperature and moisture detection sensors; 2. Soil moisture detection sensors; 3. Water consumption detection equipment; 4. IoT and cloud platforms.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Conduct on-site surveys depending on agricultural facilities; 3. Detect soil moisture, temperature, etc. in real time using various sensors; 4. Select appropriate water-saving technologies and equipment for agricultural facilities based on detection data.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use sensors to detect soil moisture, temperature, etc. in accordance with standards; 1.2 Reasonably select water-saving methods depending on agricultural facilities; 1.3 Use water-saving irrigation equipment in accordance with standards. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Selection of water-saving technologies; 2.2 Rational utilization of water resources. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Classification and characteristics of water-saving technologies; 3.2 Technical architecture of the intelligent irrigation system.	

	4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management.
DESCRIPTION OF THE END PRODUCT / SERVICE	Water-saving technologies are reasonably selected depending on agricultural facilities to fully raise the efficiency and effectiveness of water use in agriculture.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Development status quo of IoT in intelligent agriculture; 2. Agricultural laws and regulations; 3. National or industry standards; 4. IoT technology; 5. Cost accounting.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SUSTAINABILITY AND RESOURCE MANAGEMENT	DUTY NO.	806
TASK TITLE	ENERGY MANAGEMENT	TASK NO.	8062
PERFORMANCE CRITERIA	The person performing this task must be able to reduce energy consumption in agricultural production, improve energy utilization efficiency, and further promote sustainable development of agriculture through the energy management system.		
RANGE STATEMENT	The task can be performed within intelligent agricultural facilities under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Energy management platforms; 2. Computers; 3. IoT in intelligent agriculture; 4. Cloud platforms.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Reduce energy consumption through effective energy management; 3. Lower energy costs using reasonable energy management measures; 4. Reduce pollution and damage to the environment for sustainable agricultural development using effective energy management measures.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Reduce energy consumption through effective energy management; 1.2 Lower energy costs using reasonable energy management measures; 1.3 Reduce pollution and damage to the environment for sustainable agricultural development using effective energy management measures. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Energy management in the agricultural industry; 2.2 Refined management of agricultural energy; 2.3 Energy reuse. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Renewable energy technology use process; 3.2 Classification of energy management measures. 4.0 Essential Skills	

	4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management.
DESCRIPTION OF THE END PRODUCT / SERVICE	Real-time monitoring, optimization and adjustment of energy consumption in agricultural production are implemented using modern scientific and technological means to improve the efficiency of agricultural production and energy utilization.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Energy management systems; 2. Agricultural laws and regulations; 3. National or industry standards.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SUSTAINABILITY AND RESOURCE MANAGEMENT	DUTY NO.	806
TASK TITLE	CLIMATE CHANGE ADAPTATION	TASK NO.	8063
PERFORMANCE CRITERIA	The person performing this task must be able to respond to the impacts of climate change by adopting effective climate adaptation strategies and technologies to enhance agricultural production capacity and farmers' livelihoods.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Intelligent agricultural meteorological stations; 2. IoT; 3. Cloud platforms; 4. Record books and pens; 5. Computers.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Select appropriate tools and equipment for the task; 3. Use intelligent agricultural meteorological stations for meteorological data acquisition; 4. Analyse meteorological data; 5. Select effective technologies and strategies for climate change adaption based on the analysis results of meteorological data.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Use intelligent agricultural meteorological stations in accordance with standards for meteorological data acquisition; 1.2 Analyse the acquired meteorological data; 1.3 Select effective technologies and strategies for climate change adaptation in intelligent agriculture. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Selection of technologies and strategies for climate change adaptation. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Impacts of climate change on agricultural production; 3.2 Operational approaches to climate change adaptation technologies.	

	4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management.
DESCRIPTION OF THE END PRODUCT / SERVICE	Effective solutions are provided for agricultural production to cope with climate change and improve the adaptability of crops according to climate changes in agricultural facilities.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Meteorological knowledge; 2. Agricultural knowledge; 3. Agricultural laws and regulations; 4. National or industry standards.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SUSTAINABILITY AND RESOURCE MANAGEMENT	DUTY NO.	806
TASK TITLE	PREDICTIVE ANALYSIS OF INTELLIGENT AGRICULTURE	TASK NO.	8064
PERFORMANCE CRITERIA	The person performing this task must be able to analyse the data after the implementation of intelligent agriculture and predict the potential economic benefits.		
RANGE STATEMENT	The task can be performed within intelligent agricultural facilities under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. IoT in intelligent agriculture; 2. Cloud platforms; 3. Computers; 4. Printers; 5. Data analysis software.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Select appropriate tools and equipment for the task; 3. Use scientific and effective prediction techniques to predict and analyse intelligent agriculture according to data analysis results; 4. Write predictive analysis reports.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Correctly collect and organize data information about intelligent agriculture; 1.2 Accurately predict and analyse intelligent agriculture. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Predictive analysis of intelligent agriculture. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Operational methods for data collection and predictive analysis techniques; 3.2 Method for writing predictive analysis reports. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills;	

	4.4 Report writing skills; 4.5 Time management.
DESCRIPTION OF THE END PRODUCT / SERVICE	The intelligent agriculture is correctly predicted and analysed according to the collection and collation of data information about intelligent agriculture.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Intelligent agriculture; 2. IoT-based intelligent agriculture; 3. Agricultural laws and regulations; 4. National or industry standards.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE SUSTAINABILITY AND RESOURCE MANAGEMENT	DUTY NO.	806
TASK TITLE	INTELLIGENT AGRICULTURE MANAGEMENT AND DECISION-MAKING	TASK NO.	8065
PERFORMANCE CRITERIA	The person performing this task must be able to utilize IoT technology and data analysis methods to conduct intelligent management and decision-making on agricultural planting, breeding, water conservancy, etc., so that farmers can use resources more efficiently and increase output, thereby realizing the sustainable development of intelligent agriculture.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior intelligent agriculture engineers. The tools and equipment to be used include: 1. Intelligent agriculture monitoring systems; 2. IoT; 3. Cloud platforms; 4. Data analysis software.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe health and safety precautions when performing this task; 2. Use intelligent devices such as sensors and monitors to monitor soil, weather, lighting, and other data in real time, and provide care management and decision-making suggestions for planting; 3. Utilize monitoring and IoT technologies to monitor and control the breeding environment in real time, and provide more accurate, effective, and safe management and decision-making suggestions for cultured species; 4. Use intelligent agricultural equipment to monitor soil moisture and temperature data, and provide suggestions for water resource management and decision-making based on the recommendations provided by the data model.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Analyse real-time monitoring data to provide care management and decision-making suggestions for planting; 1.2 Analyse real-time monitoring data to provide accurate, effective, and safe management and decision-making suggestions for cultured species; 1.3 Analyse real-time monitoring data to provide effective management and decision-making recommendations for water resources. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Efficient management of intelligent agriculture; 2.2 Continuous management of intelligent agriculture; 2.3 Green management of intelligent agriculture. 3.0 Theories The person performing this task must be able to explain the following:	

	3.1 Planting management and decision-making process in intelligent agriculture; 3.2 Breeding management and decision-making process in intelligent agriculture; 3.3 Water management and decision-making process in intelligent agriculture. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management.
DESCRIPTION OF THE END PRODUCT / SERVICE	Intelligent management and decision-making are carried out for planting, breeding, water conservancy and other aspects in agriculture based on IoT technology and data analysis means.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Data analysis technology; 2. Agricultural product quality control; 3. Agricultural laws and regulations; 4. National or industry standards; 5. Intelligent agriculture management systems.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE MARKETING AND PROMOTION	DUTY NO.	807
TASK TITLE	AGRICULTURAL PRODUCT MARKETING PLANNING	TASK NO.	8071
PERFORMANCE CRITERIA	The person performing this task must be able to conduct market research on the sales of agricultural products, analyse product highlights and characteristics according to the research results, develop corresponding marketing plans, and determine operational channels for resource allocation based on operational goals and in combination with target customers, competition and other information, to increase the sales of agricultural products.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior e-commerce operators in intelligent agriculture. The tools and equipment to be used include: 1. Computers/mobile phones; 2. Data analysis software; 3. Data logbooks.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Have a deep understanding of the supply and demand of agricultural products and consumer spending preferences; 2. Evaluate and integrate agricultural products that can be sold online, provide training services for e-commerce operators, and offer operational services for both self-built e-commerce platforms and third-party e-commerce platforms; 3. Understand market trends and consumer demands using big data analysis tools; 4. Conduct e-commerce security and risk management.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Carry out daily maintenance of marketing channels; 1.2 Carry out business processing; 1.3 Provide customer services; 1.4 Analyse business data; 1.5 Position and maintain the brand. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Accuracy of market research; 2.2 Integrated online and offline supervision; 2.3 Resource integration. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic knowledge of computer operating system applications; 3.2 Basic knowledge of data processing;	

	3.3 Basic business process of e-commerce; 3.4 Main methods of network marketing. 4.0 Essential Skills 4.1 Learning skills; 4.2 Communication skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Time management.
DESCRIPTION OF THE END PRODUCT / SERVICE	The market research is carried out on agricultural products and corresponding marketing plan is formulated to increase sales.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Common sense of network security; 2. National or industry standards; 3. Knowledge of relevant laws and regulations.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE MARKETING AND PROMOTION	DUTY NO.	807
TASK TITLE	AGRICULTURAL PRODUCT QUALITY AND SAFETY TRACEABILITY QUERY	TASK NO.	8072
PERFORMANCE CRITERIA	The person performing this task must be able to develop and implement corresponding blockchain applications based on user requirements in different application scenarios, and conduct agricultural product quality and safety traceability queries.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior blockchain operators in intelligent agriculture. The tools and equipment to be used include: 1. Computers/mobile phones; 2. Sensors; 3. Agricultural meteorological stations; 4. Data analysis software; 5. Data logbooks.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Install, configure, deploy, and maintain the blockchain system, to ensure its stability and security; 2. Develop and implement corresponding blockchain applications according to the needs of different fields to improve system functionality and efficiency; 3. Carry out daily operation and management of the blockchain system, to ensure its normal operation; 4. Monitor the blockchain system in real time, identify and resolve problems in the system, to ensure its normal operation; 5. Take on the backup, recovery, and management of data in the blockchain system, to ensure data security and integrity.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Deploy the blockchain system on various hardware and software platforms; 1.2 Monitor, manage, and maintain the blockchain system; 1.3 Develop applications based on blockchain; 1.4 Solve technical issues in the blockchain system and applications; 1.5 Ensure the security of the blockchain system. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Comprehensiveness, truthfulness, accuracy and timeliness; 2.2 Integrated online and offline supervision. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic knowledge of blockchain;	

	3.2 Commonly-used technical frameworks of blockchain. 4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Blockchain technology and tools are used to develop and implement corresponding blockchain applications based on user requirements in different application scenarios.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. Laws and regulations related to blockchain; 2. Knowledge of network security.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE MARKETING AND PROMOTION	DUTY NO.	807
TASK TITLE	PROMOTION OF THE CONCEPT AND TECHNOLOGY OF INTELLIGENT AGRICULTURE	TASK NO.	8073
PERFORMANCE CRITERIA	The person performing this task must be able to promote intelligent agriculture through lectures, seminars, and other activities, and provide technical services for farmers and rural enterprises to help them solve practical problems encountered in the implementation of intelligent agriculture.		
RANGE STATEMENT	The task can be performed in offices under the supervision of senior training and promotion officers in intelligent agriculture. The tools and equipment to be used include: 1. Computers/mobile phones; 2. Commonly-used intelligent agricultural equipment (driverless tractors, precision irrigation systems, pesticide spraying drones, etc.); 3. Data analysis software; 4. Data logbooks.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The training and promotion officers in intelligent agriculture must be able to do the following: 1. Organize regular training activities to deliver knowledge related to intelligent agriculture (definition, development process, main technologies, etc.) to farmers, and utilize modern information technology to improve agricultural production efficiency; 2. Strengthen cooperation with agricultural enterprises, governments, and research institutions to drive the development of intelligent agriculture; 3. Provide consulting services for farmers and rural enterprises.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Select suitable intelligent agricultural equipment (e.g. driverless tractors, precision irrigation systems, pesticide spraying drones, etc.) to complete farmland cultivation, sowing, fertilization, irrigation, etc.; 1.2 Utilize big data and artificial intelligence to collect farmland data for precise fertilization and irrigation; 1.3 Monitor the real-time data of farmlands using remote sensing technology such as artificial satellite, to timely detect diseases and insect pests, drought and other problems, and respond in time to prevent loss; 1.4 Sell agricultural products directly to consumers through the Internet platform, to reduce intermediate links and increase income. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Precise perception in the production process;	

	2.2 Intelligent management; 2.3 Digital transformation. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Application scenarios and technologies of intelligent agriculture; 3.2 Training methods and techniques of intelligent agriculture. 4.0 Essential Skills 4.1 Case summary and sharing skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The concept and technology of intelligent agriculture are promoted to farms and rural enterprises to help them improve production efficiency and increase income.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. IoT; 2. Cloud computing; 3. Big data; 4. Artificial intelligence.

OCCUPATION	INTELLIGENT AGRICULTURE ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTELLIGENT AGRICULTURE MARKETING AND PROMOTION	DUTY NO.	807
TASK TITLE	TECHNICAL EDUCATION AND TRAINING IN INTELLIGENT AGRICULTURE	TASK NO.	8074
PERFORMANCE CRITERIA	The person performing this task must be able to timely carry out agricultural technology extension and service activities, and provide technical services for farmers and rural enterprises according to their actual production situation to help them address the technical challenges encountered in their actual production processes.		
RANGE STATEMENT	The task can be performed at training venues under the supervision of senior technology trainers in intelligent agriculture. The tools and equipment to be used include: 1. Computers/mobile phones; 2. Commonly-used intelligent agricultural equipment; 3. Data analysis software; 4. Data logbooks.		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The technology trainers in intelligent agriculture must be able to do the following: 1. Skillfully use the knowledge and technology of intelligent agriculture to guide actual agricultural production activities; 2. Provide training on crop fertilization, watering, pruning and other basic management techniques; 3. Provide training on the identification and prevention techniques of diseases and insect pests; 4. Provide training on the operation and maintenance, troubleshooting and repair techniques of advanced agricultural machinery.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Help students master the basic concepts and technologies of intelligent agriculture through teaching and guidance; 1.2 Organize and implement practical activities related to intelligent agriculture technology; 1.3 Provide intelligent agriculture technology consulting and guidance services; 1.4 Participate in research and project development related to intelligent agriculture. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Safety operation of agricultural machinery; 2.2 Combination of expertise and practice. 3.0 Theories The person performing this task must be able to explain the following: 3.1 Basic technical operation process in intelligent agriculture;	

	3.2 Technical training and guidance methods. 4.0 Essential Skills 4.1 Communication skills; 4.2 Customer service skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Learning skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The application, promotion and service of digital technology are implemented in agricultural production and rural life.
CIRCUMSTANTIAL KNOWLEDGE	Detailed knowledge about: 1. IoT; 2. Cloud computing; 3. Big data; 4. Artificial intelligence.

Table 1: DACUM CHARTS FOR INTELLIGENT AGRICULTURE ENGINEER - NTA 8

DUTIES	TASKS	ENABLERS
1.0 Intelligent agriculture sensor network design	1.1 Field monitoring of intelligent agriculture data.	General skills and knowledge • Basic agricultural knowledge • Knowledge of sensor technology • Data processing and analysis methods • Knowledge of wireless communication technology • Basic knowledge of software development and programming • Knowledge of agricultural information technology • Basic principles and methods of project management • Computer skills Tools and equipment • Printers • Computers • Programming and data analysis software • Device debugging tools • Network devices and instruments • Laboratory equipment and tools Materials • N/A Requirements for employees • Innovation skills • Emphasis on commitment • Good professional ethics
	1.2 Identification and selection of intelligent agricultural sensing devices.	
	1.3 Intelligent agricultural system design.	
2.0 Installation and debugging of intelligent agriculture sensor network infrastructure	2.1 Installation of intelligent agricultural system devices.	General skills and knowledge • Basic agricultural knowledge • Basic electronic knowledge • Knowledge of embedded systems • Basic principles and technologies of network communication • Basic knowledge of computer network
	2.2 Installation of intelligent agricultural system network.	
	2.3 Debugging of intelligent agricultural system.	

		• Data security and privacy protection • Knowledge of sensors and devices • Knowledge of software platforms and applications • Data recording and management • Basic principles and methods of project management • Computer skills Tools and equipment • Printers • Computers • Programming and data analysis software • Special tools for device debugging • Network devices and instruments • Special laboratory equipment, conventional tools, and security devices Materials • IoT gateways • Wires and cables • Fixed supports Requirements for employees • Innovation skills • Emphasis on commitment • Good professional ethics • Learning skills
3.0 Detection, operation and maintenance of intelligent agriculture sensor network	3.1 Detection of intelligent agricultural system.	General skills and knowledge • Use and maintenance of sensors and measuring instruments • Data acquisition and analysis • Network communication and security • Electronic circuits and control systems • Basic knowledge of agricultural systems • Project management
	3.2 Operation and maintenance of intelligent agricultural system.	
	3.3 Intelligent agricultural system failure handling.	

		Tools and equipment • Sensors and measuring instruments • Data acquisition equipment • Communication devices • Electronic testing instruments • Computers, data processing software, and databases • Screwdrivers, wrenches, pliers, and other commonly-used maintenance tools • Safety helmets, gloves, protective goggles, and other personal protective equipment Materials • Cables and connectors, power cords, USB cables, plugs, and sockets • Sensor holders, retaining clamps, bolts and nuts • Batteries and battery trays • Protective covers and materials • Identification and labeling • Insulating materials Requirements for employees • Sense of responsibility • Honesty and trustworthiness • Good moral quality • Patience and meticulousness • Solidarity and cooperation • Confidentiality consciousness • Continuous learning
4.0 Secondary development of intelligent agricultural management system	4.1 Project construction management.	General skills and knowledge • Project requirement survey skills • Risk analysis skills • Project construction management skills • Cloud platform operation monitoring skills • Data acquisition
	4.2 Development of intelligent agricultural sensors and data acquisition units.	
	4.3 Monitoring of cloud platform data acquisition, processing and development.	

		• State management skills for intelligent agricultural sensors • Plan formulation skills • Data acquisition and development skills • Network data management skills • Basic knowledge of data monitoring • Simple coding skills • Learning skills • Communication skills • Report writing skills Tools and equipment • Computers • Sensors • Intelligent agriculture monitoring systems • Intelligent agriculture monitoring cloud platforms • Servers • Storages Materials • N/A Requirements for employees • Emphasis on commitment • Good moral quality • Self-motivation
5.0 Application of intelligent agriculture sensor network technology	5.1 Automatic identification of crop diseases and insect pests.	General skills and knowledge • Basic knowledge of agricultural diseases and insect pests • Basic knowledge of the physiological state of crops • Basic knowledge of fruit recognition • Artificial intelligence • Machine learning • Deep learning • Sensor networks • IoT • Big data
	5.2 Intelligent identification of the physiological state of crops.	
	5.3 Fruit recognition.	

		Tools and equipment • Intelligent identification devices (e.g. cameras, UAVs, etc.) • Sensor network devices (e.g. soil sensors, meteorological sensors, etc.) • Data analysis software (e.g. Python, R, etc.) Materials • Disease and insect pest sample data • Crop growth environment data • Sample data on crop physiological state • Crop growth environment data • Fruit sample data • Fruit characteristic data Requirements for employees • Communication and coordination skills • Strong learning skills • Certain innovation ability • Patience and meticulousness
6.0 Intelligent agriculture sustainability and resource management	6.1 Water-saving technology.	General skills and knowledge • Water-saving technology • Energy management skills • Technologies and strategies for climate change adaptation • Predictive analysis technique of intelligent agriculture • Intelligent agriculture management and decision-making technology • Data analysis and recording capabilities Tools and equipment • Printers • Computers • IoT • Cloud platforms • Sensors
	6.2 Energy management.	
	6.3 Climate change adaptation.	
	6.4 Predictive analysis of intelligent agriculture.	
	6.5 Intelligent agriculture management and decision-making.	

		Materials • Paper Requirements for employees • Emphasis on commitment • Good moral quality • Self-motivation
7.0 Intelligent agriculture marketing and promotion	7.1 Agricultural product marketing planning.	General skills and knowledge • Basic business process of e-commerce • Knowledge related to network security • Knowledge related to the concept and technology of intelligent agriculture • Knowledge of statistics • Daily maintenance skills for operational channels • Network marketing skills • Skills for operating advanced equipment in intelligent agriculture • Computer application skills • Report writing skills Tools and equipment • Computers • Mobile phones • Soil moisture sensors, water and fertilizer integrated machines, agricultural drones, and agricultural meteorological stations • Data logbooks • Data analysis software Materials • Crop samples Requirements for employees • Sense of responsibility • Emphasis on commitment • Good moral quality • Integrity • Self-motivation
	7.2 Agricultural product quality and safety traceability query.	
	7.3 Promotion of the concept and technology of intelligent agriculture.	
	7.4 Technical education and training in intelligent agriculture.	