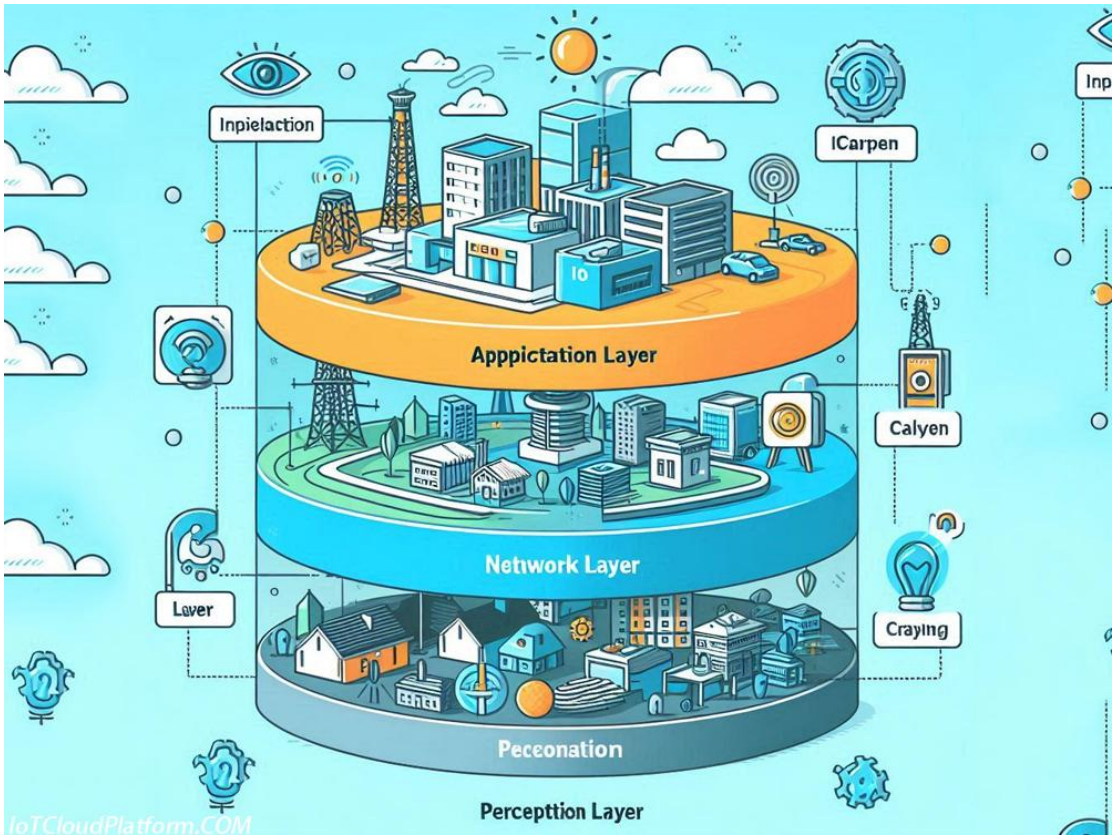
Smart Home Training Room Solutions (2025 Latest Edition)

I. Overview

(I) Definition and Characteristics of the Internet of Things

The **Internet of Things (IoT)** is a network ecosystem that uses intelligent sensing devices such as **radio frequency identification (RFID)**, infrared sensors, global positioning systems, laser scanners, etc. to achieve information interaction and communication between objects according to established protocols, thereby building a network ecosystem with functions such as intelligent identification, precise positioning, real-time tracking and intelligent supervision.



As an extension of the Internet and traditional telecommunications networks, the Internet of Things realizes the digital identification and interconnection of physical objects, and has three core features:

Physical object equipment: transforming ordinary objects into smart terminals

Terminal equipment interconnection: realizing autonomous communication and collaboration between devices

Service application intelligence: providing universal smart services

From the perspective of technical architecture, the Internet of Things includes three key levels:

Perception layer: responsible for data collection and object recognition

Network layer: realizing data transmission and processing

Application layer: providing smart services based on data analysis

(II) Internet of Things Engineering

(1) Discipline definition and research field

Internet of Things Engineering is a comprehensive engineering discipline that integrates information sensing, communication transmission and smart service technologies to realize the interconnection of things and the interaction of people, and ultimately achieves the goals of smart identification, precise positioning, real-time monitoring and smart management.

Its research areas include:

Sensor and data acquisition technology

Wireless communication and network transmission technology

Cloud computing and edge computing technology

Big data analysis and artificial intelligence technology

Information security and privacy protection technology

(2) Core technology system

The core technology architecture of the Internet of Things project can be divided into three levels:

1) Perception and connection layer

Use RFID, sensors and other devices to digitize the physical world

Establish a connection channel between objects and the network

2) Network and communication layer

Realize data transmission through wireless communication technologies such as 5G and LoRa

Build a reliable information exchange network

3) Intelligent service layer

Provide user-centric intelligent applications

Realize scenario-based services such as smart cities and smart transportation

(3) Application prospects and development trends

The Internet of Things project has been widely used in:

Smart home: realize the interconnection and intelligent control of home appliances

Industrial Internet: Promote the digital transformation of manufacturing industry

Smart city: Optimize urban management and public services

Smart agriculture: Improve agricultural production efficiency and management level

Future development trends:

u Deep integration with new technologies such as artificial intelligence and blockchain

u Evolution to edge computing and distributed architecture

u Strengthen security protection and privacy protection mechanisms

u Promote the digital and intelligent transformation and upgrading of

various industries

u Build a more open and collaborative industrial ecosystem

II. Smart Home Training Room Construction Plan

(I) Training Room Construction Overview

The smart home training room is a comprehensive practical teaching platform for the training of IoT engineering talents. By building real smart home application scenarios, it provides students with a complete practical environment from device deployment, system integration to application development. The training room is equipped with advanced IoT hardware equipment, network infrastructure and software development platform to support multi-level and multi-type practical teaching needs.

(II) Training Room Core Configuration

(1) Hardware Equipment System

Perception Layer Equipment: **Temperature and Humidity Sensors**, Light Sensors, Human Infrared Sensors, Smoke Detectors, etc.

Execution Layer Equipment: Smart Switches, Smart Sockets, Smart Curtains, **Smart Door Locks**, etc.

Control Layer Equipment: Embedded Development Boards (such as ARM Cortex series), smart gateways, edge computing devices

Communication modules: ZigBee, WiFi, Bluetooth, LoRa and other

mainstream communication modules

Auxiliary equipment: smart home appliances, security equipment, environmental simulation devices

(2) Network infrastructure

Core network: Gigabit Ethernet switches, enterprise-level routers

Wireless coverage: wireless access points supporting 802.11ac/ax

Protocol conversion: multi-protocol gateway devices

Network security: firewalls, intrusion detection systems

(3) Software platform configuration

Development tools: embedded development environment, mobile application development platform

Cloud service platform: IoT device management platform, data analysis platform

Simulation software: smart home scene simulator

Management tools: device monitoring system, log analysis system

(III) Practical teaching system

(1) Project-based practical training content

The training room provides multi-level practical projects, including:

Basic projects: sensor data acquisition, equipment remote control

Intermediate projects: scene linkage control, smart security system

Advanced projects: AI-based intelligent decision-making system, energy optimization management system

(2) Curriculum system design

Theory Courses: IoT architecture, communication protocols, security mechanisms

Practical courses: equipment deployment and debugging, system integration, application development

Innovative courses: smart home solution design, project management

(IV) Teaching features and advantages

(1) Real scene simulation

1:1 restoration of smart home application environment

Support for multiple home scene configurations

Provide fault simulation and diagnosis functions

(2) Ability training objectives

Master the ability to design and implement IoT systems

Cultivate equipment debugging and troubleshooting skills

Improve project development and team collaboration capabilities

Cultivate innovative thinking and engineering practice capabilities

(3) Expected teaching results

Complete the ability transformation from theoretical learning to practical application

Possess the ability to independently develop smart home solutions

Gain project experience in IoT engineering practice

Lay a solid foundation for future career development

(V) Training room management mechanism

Establish equipment use and maintenance specifications

Implement project-based teaching management

Improve safety management system

Establish an achievement evaluation system

Through systematic training room construction and teaching implementation, create an immersive learning environment for students and cultivate IoT engineering talents that meet industry needs.

III. Purpose of smart home training room construction

1. Strengthen practical operation skills: The construction of the training room aims to create a highly restored IoT application scenario, so that students can carry out practical operations and practical projects in a real environment. Through such practical training, students can master IoT technology, carry out application development, testing and debugging, and effectively improve their practical skills.

2. Improve teamwork level: IoT engineering applications usually require multi-party collaboration, covering hardware equipment installation, system architecture design, software development and other links. The training room takes this as a starting point and focuses on cultivating students' teamwork ability, so that they can learn to work closely with

others in actual projects and form a good working atmosphere with clear division of labor and orderly collaboration.

3. Cultivate problem-solving ability: In real IoT application scenarios, problems and challenges such as equipment failure and abnormal data transmission are common. The training room focuses on cultivating students' ability to analyze and solve problems independently by providing rich practical operation and debugging opportunities, while stimulating their innovative thinking and improving their ability to propose innovative solutions.

4. Stimulate innovation awareness and entrepreneurial spirit: The Internet of Things Engineering Application Training Room actively encourages students to boldly propose innovative ideas and solutions in actual projects. Through practice and experiments, it fully stimulates students' innovative potential, cultivates their innovative thinking and entrepreneurial ability in the field of the Internet of Things, and lays the foundation for future innovative development.

5. Enhance practical application ability: One of the core goals of the training room is to enhance students' ability in practical applications. Through project practice for practical application scenarios in different

fields such as smart home, industrial automation, smart city, etc., students can deeply grasp the application points of Internet of Things technology in various fields, and lay a solid foundation for future job hunting and career development.

The construction of the smart home training room aims to systematically cultivate students' practical ability, teamwork ability, problem-solving ability, innovation awareness and practical application ability through all-round practice and project training, so that they can better adapt to the rapid development of Internet of Things technology and pave a solid road for students' career development.

IV. Composition of Smart Home Training Room

(I) Smart Home Training System

1. System Overview

The Smart Home Training System is a multifunctional Internet of Things teaching platform, based on the Internet of Things technology architecture, divided into perception layer, network layer and application layer. The system takes practical application scenarios such as smart home, smart agriculture, smart transportation, and smart security as the core, and provides students with a comprehensive training environment from hardware composition to business principles and application

development. Through the comprehensive application of multiple technologies such as sensor technology, RFID technology, wireless sensor network technology, Android application development, etc., combined with 433M wireless communication equipment, ZigBee nodes, radio frequency equipment, control equipment, gateways and Internet of Things cloud platforms, a comprehensive training platform integrating basic, verification, design, comprehensive and innovative development is constructed. The system supports smart home access control security monitoring, environmental monitoring, equipment control, as well as agricultural environment detection and equipment control.

2. Product Features

1) Teaching Convenience

The system is guided by the goal of cultivating smart home talents in vocational colleges, optimizes the practical training teaching design, and helps students from the recognition of Internet of Things technology to practical skills training, and ultimately improves their job capabilities.

2) Comprehensive coverage of technology

The system integrates a variety of mainstream IoT technologies, including sensor technology, data acquisition technology, radio frequency identification technology, wireless network technology, mobile Internet technology, embedded technology, intelligent terminal technology and host computer application software technology, covering all IoT-related fields.

3) Rich application scenarios

The system provides a variety of application scenarios such as smart home, smart transportation, smart agriculture, and smart environment monitoring. All functional modules are designed based on real industry applications to help students deeply understand the practical application of IoT technology.

4) Modular design, easy to expand

The software and hardware system adopts platform-based and modular design, supporting external expansion of more technical and business modules to meet different practical training needs.

5) Massive teaching resources

The system is equipped with complete practical training instructions, teaching material resources and teaching videos, and provides free installation and deployment and equipment practical training services.

3. Technical advantages

1) Wireless communication module

The wireless node can be configured through the "visual interface generator" and "visual controller", supporting dynamic adjustment of IO port functions (such as key access, digital input/output, analog input, PWM output), without re-burning firmware.

2) Visual Editor

Through the PC-side tool, users can quickly generate the device operation interface, which supports indicators, buttons, picture collections, variable windows, graphic links and other controls. The interface can be directly imported into the App for use without recompiling or installing.

3) Visual Controller

The App supports data viewing, status monitoring and action control of wireless nodes, and supports multi-node linkage operation. Users can directly configure linkage rules through the App without writing embedded or App code.

4) IoT Gateway

The communication gateway based on the ARM Cortex-M4 core supports a variety of wireless node modules (such as ZigBee, LoRa, NB-IOT), and can view node data or generate API interfaces through the Weizhong IoT cloud platform, greatly reducing development costs and time.

4. Training function

1) Basic hardware

Including Weizhong IoT gateway and IoT node, supporting ZigBee, 433M, Wi-Fi, BLE, LoRa, NB-IOT and other communication technologies, covering Android mobile Internet development, embedded development, sensor technology, execution control, network communication, .NET development and JavaScript and other technologies.

2) Training module

Using industrial-grade high-precision sensors and actuators, supporting analog/digital quantity acquisition, and providing training content such as hardware driver layer, network transmission layer and protocol conversion debugging.

3) Training project

Through the training board hardware module, complex application scenarios are formed, providing complete training content for hardware driver layer, network transmission layer and Weizhong application layer (Android and .NET).

4) Comprehensive case

Based on the case of combining the Internet of Things with specific industries, a complete development manual and source code are provided to help students deeply understand the practical application of Internet of Things technology.

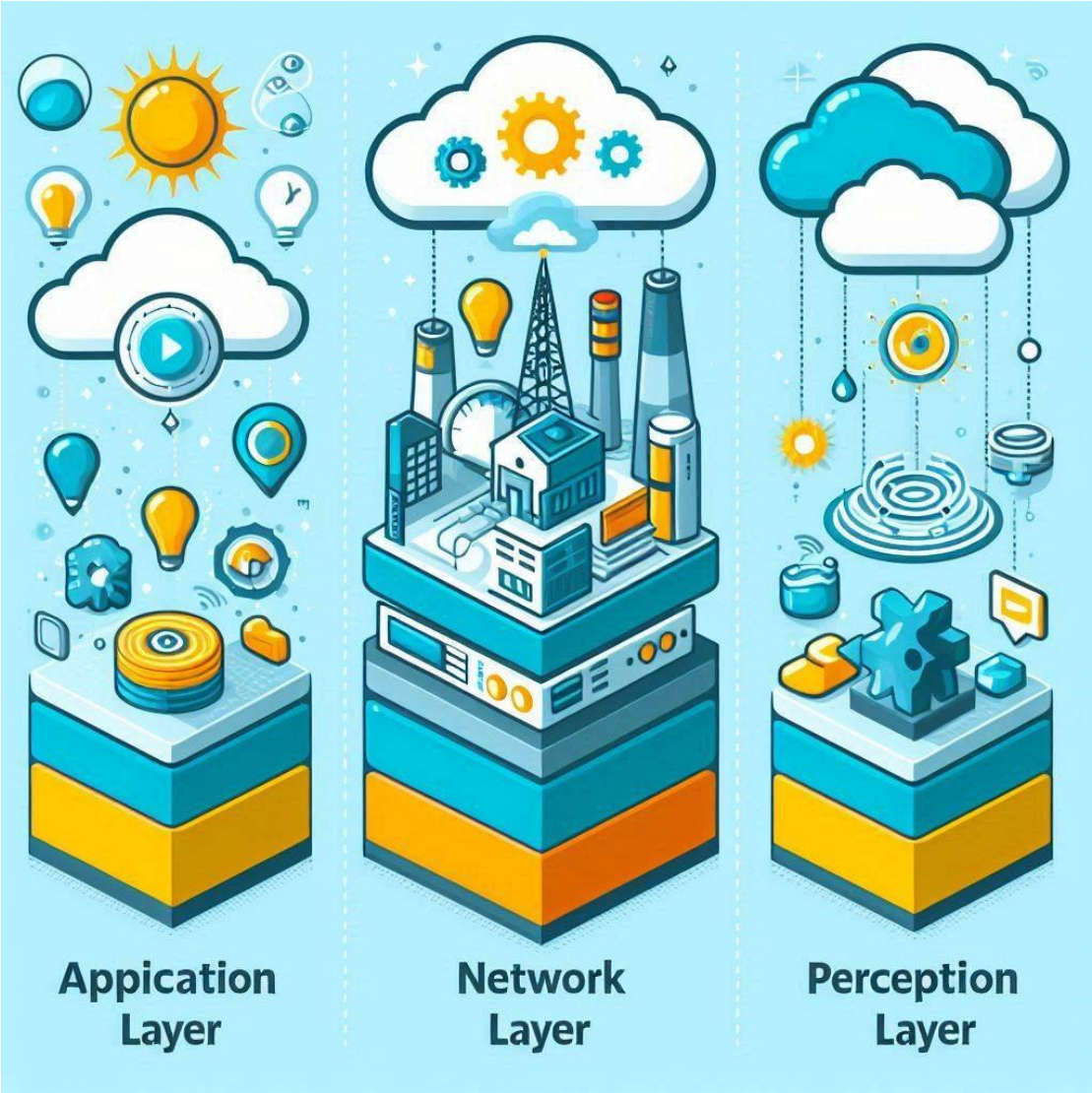
Through the above functions and features, the smart home training system provides students with a comprehensive, flexible and easy-to-expand Internet of Things learning platform, helping them to quickly master the core skills of Internet of Things technology.

(II) Internet of Things Cloud Platform

The Internet of Things Fusion Cloud Platform is a Web application designed for higher vocational colleges across the country, dedicated to building a complete Internet of Things system for colleges. With the help of this platform, students can not only deeply learn the knowledge of Internet of Things hardware and master software programming technology, but also meet the various needs of participating in the Internet of Things Skills Competition.

The platform is based on the Linux underlying layer and is carefully developed for teaching and skills competition scenarios. It adopts B/S architecture and MVC mode. It abstracts the system into object layer, presentation layer and control layer. Each layer is independent and

loosely coupled. This code organization method facilitates large-scale parallel development and lays the foundation for system upgrades, maintenance and transformation. It has strong expansion capabilities. The platform integrates teaching and competition functions. While meeting students' learning and training equipment operation needs, it can effectively improve students' familiarity with the content of skills competition assessment. Students can freely create IoT projects on the platform and control training equipment through projects. The platform supports multi-terminal operations, including PCs with Internet access, smartphones, tablets, etc., allowing students to truly experience the application of IoT technology and broad career prospects.



(1) Product Features

Convenient data management: When the service layer has a lot of sensor data and user data, the cloud supports one-click synchronization. As long as the service layer is connected to the external network, the data can be synchronized to the cloud; for gateways and sensor devices, when the service layer is connected to the external network, once the service layer changes, the data will be automatically synchronized to the cloud without repeated addition.

Diversified data analysis: The platform provides rich data statistics and analysis results, helping schools to fully understand the use of equipment and provide a strong basis for teaching and management decisions.

Strong cross-platform compatibility: Based on the Web architecture, users only need to use a web browser or mobile terminal, regardless of operating system differences. Any PC, smartphone, tablet computer and other devices that can access the Internet can access the cloud platform anytime and anywhere.

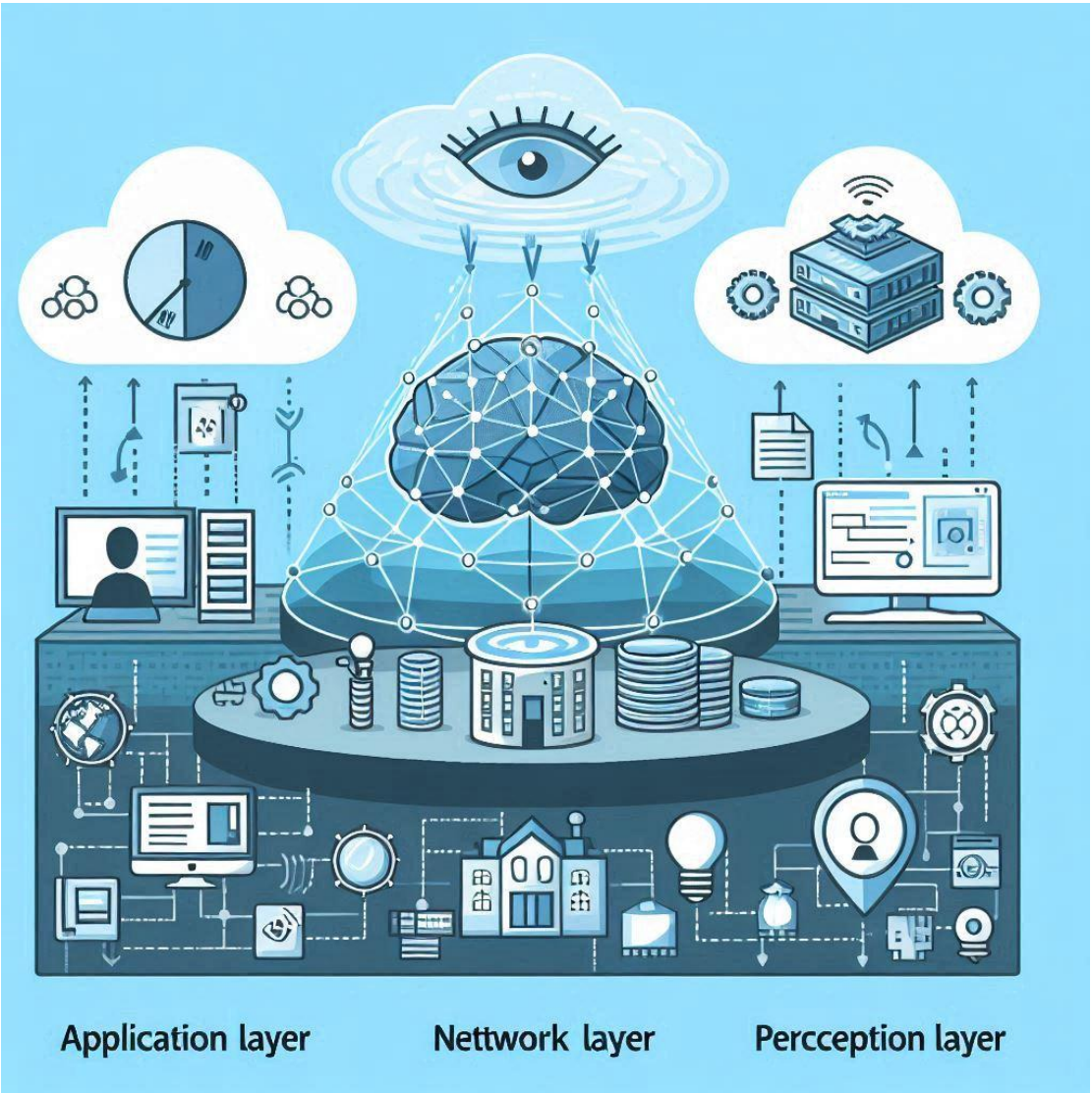
(2) Platform features

Quick access to perception layer devices: When IoT perception layer devices (such as gateways, nodes, cameras, etc.) are connected to the platform, a variety of access protocol types are provided, which is convenient and fast.

API standard output: The platform provides a unified data format standard for secondary development, which is simple to operate and not limited to development languages. Students can quickly collect data, analyze, and monitor and control equipment through the unified API interface provided by the cloud platform, and develop their own IoT

applications.

Training project management: Students can independently create, start, modify, and delete IoT projects, and generate exclusive API interface documents based on the projects to control the perception layer hardware connections within the projects.



Easy cloud access: The platform provides a complete and secure cloud data development interface, avoiding complex IoT communication protocol parsing and cloud data conversion tasks, simplifying IoT project

development and debugging processes, and enabling students to efficiently develop IoT project applications. The platform is especially suitable for IoT beginners, by quickly connecting the perception layer and the application layer, lowering the learning threshold, supporting mainstream high-level development languages, and helping students develop enterprise-level applications.

(3) Training function

Students can freely create IoT projects on the front-end training page. After creation, they can configure the project, such as adding devices, sensors, and configuring strategies. After completing the configuration,

students can generate API interface documents and then refer to the documents for programming to achieve control of the training equipment.

(III) Graphical programming tool

The graphical programming tool is a visual programming environment based on drag-and-drop design, designed for programming beginners, enabling them to easily learn and master programming concepts and techniques through an intuitive graphical interface. This easy-to-use graphical programming tool greatly reduces the difficulty of getting started with programming, allowing students to understand complex programming language structures through visual logic blocks, effectively solving the problem of difficulty in getting started with programming syntax.

(1) Core features

Based on Blockly modules: The tool uses Google's Blockly language module and represents the hardware underlying driver library through a series of graphical modules. Users only need to combine these modules like puzzle pieces to define programming elements such as variables, functions, and input and output.

Intuitive connection method: Graphical modules are connected to each other in an intuitive way to form a top-down structure that accurately maps the relationship and hierarchy between actual codes, thereby simplifying the traditional text coding process.

Support multiple programming language output: The program composed

of graphical modules can be converted into executable C language or Python code, which not only helps beginners understand programming logic, but also lays a solid foundation for further learning of advanced programming languages.

(2) Advantages of use

Simplify the programming learning curve: Through the graphical interface, students can more intuitively understand the basic concepts of programming, such as loops, conditional judgments, and function calls, without having to face complex syntax details at the beginning.

Promote hands-on practical ability: Graphical programming encourages students to do hands-on operations, try different logical combinations, and quickly see the results feedback, which stimulates their creativity and problem-solving ability.

Seamless transition to text programming: Since the graphical programming tool ultimately generates standard C language or Python code, students can smoothly transition to traditional text programming after becoming familiar with the basic programming logic, paving the way for in-depth learning of programming.

In general, the graphical programming tool provides an interesting and practical learning platform, which is particularly suitable for programming novices. It displays the core ideas of programming in a visual way, making programming learning more intuitive and efficient,

and helping to cultivate students' logical thinking ability and innovation ability.

V. List of Smart Home Training Room Solutions

SN	Product Name	quantity	unit
1	Training workstation	51	units
2	Training workbench	50	sets
3	Realize the construction of room culture	1	item
4	Smart Home Training System	10	sets
5	IoT Cloud Platform	1	item
6	Course Resources	1	set
7	Graphical programming tool	1	item
8	Visual interface design tool	1	set
9	Training room monitoring system	1	set

VI. Value of the IoT Engineering Application Training Room Solution

1. Professional Teaching Support

(1) Teaching Environment and Resources

The training room provides a comprehensive software and hardware

teaching environment and training resources for information technology (such as integrated wiring, IoT, smart home, smart security, electronic information, embedded, mobile Internet, etc.), covering knowledge systems and skill training from basic to advanced.

(2) Technical Level and Knowledge Points

Technical level	Knowledge system	Knowledge points
Application layer	IoT applications	Application development of smart homes, smart cities, smart agriculture, smart transportation, smart factories, smart healthcare, smart communities, etc.
	IoT system maintenance	System basics, equipment usage, fault location
	Mobile Internet Technology	Android embedded programming, mobile APP development, Web application development (HTML5, JavaScript)
Platform	IoT cloud	Middleware, data center, virtualization,

layer	service	big data, MQTT server, cloud computing application development
	Database technology	Big data technology, database programming, data security, MQTT protocol
	Internet of Things Information Security	Wireless sensor network encryption, gateway encryption and authentication, database security
Network Layer	Smart Gateway	Linux operating system, M2M, MQTT, TCP/UDP gateway services
	Network Technology	LAN, Industrial Ethernet, Network Server, Network Programming
	ZigBee technology	ZigBee protocol stack, CC2530 development, wireless sensor network design
	Bluetooth BLE technology	Bluetooth 4.0 protocol stack, node design, network design, SOC programming
	Wi-Fi technology	Wi-Fi protocol stack, node design, embedded programming, network design
	NB-IOT technology	NB-IOT protocol, node design, Contiki system development

	LoRa technology	LoRa/LoRaWan protocol, node design, Contiki system development
Perception Layer	Microprocessor technology	51 processor, STM32 development, single-chip microcomputer interface technology, sensor operating system, power management
	Perception execution	Sensor principles, data acquisition and processing, motor drive, switch device control
	RFID technology	RFID principle, frequency band and instruction set, tag technology, QR code technology

2. 1+X certification service

Provide the following 1+X certificate training resources:

IoT smart home system integration and application (elementary, intermediate, advanced)

IoT sensor network development (elementary, intermediate, advanced)

Web front-end development (elementary, intermediate)

3. Smart home system integration and application

Certificate Level	Talent standards	Knowledge points	Training equipment

Beginner	Smart home system construction, installation, integration, debugging, fault detection and maintenance	Equipment selection, solution design, system installation and debugging, testing and operation and maintenance	IoT smart home training platform: sensor, controller, gateway and other equipment identification and configuration
Intermediate	Customized product design, system integration, cloud device installation and debugging, fault detection and troubleshooting	Equipment selection, solution design, system development (Web, APP, cloud platform)	IoT smart home training platform, IoT fusion cloud platform, graphical programming software, case package

Advanced	Customized product design, system architecture design, IoT operating system installation, equipment debugging and optimization	Equipment selection, solution design, system development (Web, APP, cloud platform), artificial intelligence application development	IoT smart home training platform, IoT fusion cloud platform, graphical programming software, case package

4. Sensor network application development

Certificate Level	Talent standards	Knowledge points	Training equipment
Beginner	Inspection and testing, installation and debugging,	Data acquisition (analog, digital, switch), wired and wireless	Internet of Things basic teaching and training

	prototype testing	communication (RS485, ZigBee, NB-IOT)	area: Internet of Things engineering application training device, ZigBee resource package
Intermediate	Coding implementation, function verification, system debugging	Data acquisition, wired and wireless communication (RS485, ZigBee, Wi-Fi, BLE, LoRa), protocol design	Internet of Things basic teaching and training area: Internet of Things engineering application training device, ZigBee

			resource package, Internet of Things integrated cloud platform
Advanced	Protocol design, software development, performance optimization	Data acquisition, wired and wireless communications, protocol design, software development	Internet of Things basic teaching and training area: Internet of Things engineering application training device, ZigBee resource package, Internet of

			Things integrated cloud platform

5. Web front-end development

Certificate Level	Talent standards	Knowledge points	Training equipment
Beginner	Static web page development and beautification	HTML, CSS, JavaScript, jQuery, CSS3, HTML5	Smart home training area, IoT cloud platform, smart home teaching cloud platform
Intermediate	Dynamic web design and development	HTML、CSS、JavaScript、Bootstrap、	Smart home training area,

		MySQL、PHP、RESTful API、Ajax、Laravel	Internet of Things cloud platform, smart home teaching cloud platform

6. Skills competition support

(1) Internet of Things technology application and maintenance

Competition content: C language, single-chip microcomputer, ZigBee, C#

Assessment content: engineering design, equipment installation and debugging, application development, professional quality

(2) Smart home installation and maintenance skills competition

Competition content: C language, single-chip microcomputer, ZigBee, smart home

Assessment content: mobile terminal configuration, gateway configuration, equipment installation and debugging, safety specifications

(3) Mobile Internet software competition

Assessment content: system documentation, program debugging, functional coding, creative design

(4) Embedded application development competition

Assessment content: electronic assembly process, track tasks and functional testing, troubleshooting, safe operation specifications

(5) Smart home skills competition support

5G technology application development competition: technical support and service

Belt and Road BRICS skills development and innovation competition

Building intelligent installation and debugging: video security, intrusion alarm, access control and other systems.