



# Research on the Function of Smart Training Room Based on IOT Technology

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**Abstract.** Currently most of the training rooms are traditional training rooms and do not match the training needs in the new situation. This paper proposes a kind of smart training room function demand based on IOT technology. The function and training mode of the training rooms are researched and analyzed. The type of training room is classified scientifically, data collection is conducted according to different types. And the construction demand of each type of training room is analyzed. It provides reference for the smart training room function construction based on IOT technology. And provides solutions for realizing intelligent and modern teaching means and achieving the goal “easy teaching, easy learning, easy using”.

**Keywords:** Internet of things · smart training room · classification research

## 1 Introduction

At present, most of the training rooms in universities are traditional training rooms. The equipment, environment and classroom status information of the training rooms are not obtained in time, which cannot meet the training needs under the new situation. It's mainly reflected in two aspects: one is the management of the training room. Most of the training rooms are scattered, and there are difficulties in daily management and maintenance; Equipment failure monitoring is not timely, and it's difficult to count equipment assets; Lack of environmental sensing device, unable to monitor the environmental status of the training room in real time, and so on. Second is the distance education. During the epidemic period, teachers conducted live teaching through the network platform. The courses carried out were mainly theoretical. Although a few practical training courses could be carried out in the training room, students could not participate in the practical training process, and the teaching effect was poor.

Some universities have carried out campus digital construction by using new information and communication technology. The digital and smart training room has been realized to a certain extent. In terms of training room management, some universities have studied some smart classroom management systems by using 5G, cloud computing, IOT, blockchain, MR, mobile Internet and web development technologies [1–3]. In

terms of the construction of simulation training platform, some universities have also carried out research on the construction of virtual simulation laboratory and the design of cloud smart training room [4–6]. To realize scientific planning, reasonable construction, high efficiency and practicality of the training base. However, although these studies can improve and enrich the functions of the training room to a certain extent, there are still many defects. First, repeated construction, independent design of each platform, without considering the later expansion and other issues. Second, the lack of a unified management platform, data incompatibility between application platforms, maintenance difficulties. Third, it's only designed for individual training rooms, without considering the personalized needs of different training rooms. Fourth, the effectiveness is low. Students cannot experience the convenience brought by smart campus, but complicate the process.

In view of these problems, this paper classifies the training rooms according to the functional positioning and training methods. Studies the collected data of the training rooms according to the categories, analyzes the construction needs of various types of training rooms. And studies the functions of the management and teaching platform suitable for various types of training rooms. It provides a unified standard and scheme reference for the construction of smart training room based on IOT technology.

## **2 Demand Analysis of Smart Training Room**

According to the different training equipment and training methods in the current training room, the training room can be divided into three types: digital simulation training room, physical simulation training room and mixed simulation training room. The training equipment in the digital simulation training room is mainly composed of computer terminals, and all training operations are simulated by the simulation system in the computer. The training equipment of the physical simulation training room is mainly composed of the actual on-site equipment. The training room is built into an environment basically consistent with the work site, and the training operation is completed on the real equipment. Mixed simulation training room has both computer simulation environment and on-site working environment. it's a more complex training room category to carry out training through the combination of simulation software and on-site actual equipment.

### **2.1 Current Situation of Training Room**

Based on the importance attached by the state to skilled talents, there are at least a dozen or more training rooms set up by various professional departments, which are scattered and inconvenient to manage. The doors and windows, lighting, air-conditioning, power supply, equipment, etc. of the training room need to be managed by the training room administrator or lecturer. If the maintenance is not timely, the normal class or use may be affected under special circumstances.

At present, the training teaching adopts the traditional teaching mode, which lacks new teaching methods such as interactive teaching, live and recording. With the development of information technology, the traditional teaching mode has been unable to meet the current training and teaching needs. Although some digital simulation and mixed

**Table 1.** Basic equipment configuration of various types of training rooms

Basic equipment	Physical simulation (outdoor)	Physical simulation (indoor)	Digital simulation	Mixed simulation
Power Supply	✓	✓	✓	✓
Doors and windows		✓	✓	✓
Air-conditioner		✓	✓	✓
Tables and chairs		✓	✓	✓
Whiteboard	✓	✓	✓	✓
Training equipment	✓	✓		✓
Safety tools and instruments	✓	✓		✓
Teacher computer		✓	✓	✓
Student computer			✓	✓
Simulation system			✓	✓
Projector		✓	✓	✓
Monitor		✓	✓	✓
Network			✓	✓

simulation training rooms use multimedia network teaching software to realize teaching broadcasting in teaching, physical simulation training rooms still use traditional projectors or teaching whiteboards. And the definition and resolution of the interface are relatively low, especially in recording and broadcasting or live broadcasting courses.

In the process of network live broadcast teaching, digital simulation and mixed simulation training can realize the interactive teaching experience of practical training courses through the way of sharing screen on the teacher side and using the simulation system on the student side. However, the physical simulation training room doesn't have a simulation system environment. Although some universities have set up remote live teaching of physical simulation courses, the training and teaching effect is not ideal because students cannot actually participate in the process of training operation.

## 2.2 Management Needs of Training Room

Through the investigation of the basic equipment and facilities of the training room, the basic equipment configuration of different types of training rooms is shown in Table 1. The data in the table is only for most training rooms, and there will be slight differences in the configuration of individual training rooms.

Through comparative analysis, it can be seen that for these kinds of training rooms, the basic configuration requirements of physical simulation (indoor), digital simulation and mixed simulation training rooms are similar. The general configuration includes power supply, doors and windows, air-conditioner, tables and chairs, whiteboards,

teacher computers, projectors, monitoring, etc. The differential configuration lies in student computers, training equipment, simulation systems, safety tools and networks. The physical simulation (outdoor) training room has almost no other configuration except whiteboard, training equipment and safety tools. And whiteboard and safety tools are generally brought to the training place by the trainer during class and are not kept in the training place.

There are many kinds of equipment and facilities, and it's impossible to obtain the access information and use information of equipment in real time by manual management. Asset inventory will consume a lot of human and material resources, and the statistical results are not accurate enough. The training room administrator cannot monitor the current use status, equipment borrowing status, and the operation status of doors and windows, air-conditioners, computers and other equipment in the training room in real time.

The existing training room doesn't have the function of environmental monitoring, so it's unable to monitor the potential safety hazards of the training room in real time. In the manual management mode, if the administrator fails to supervise in place, once there's a security risk, it'll bring great losses to the training room.

Therefore, the functions of the smart training room should meet the unified management needs of equipment and facilities, to realize the management of equipment status, asset and safety monitoring through the management platform.

### 2.3 Teaching Needs of Training Room

The classroom form supported by the traditional classroom is increasingly mismatched with the current training and teaching needs. With the continuous development of information technology, revolutionary changes have taken place in the way of knowledge acquisition and teaching, and the relationship between teaching and learning. Many universities have made positive attempts in the construction of smart classrooms. As a product of the deep integration of technology and education, smart classrooms organically integrate the IOT, automatic recording and broadcasting, distance teaching and interactive teaching, and build a new talent training mode under the condition of "Internet +" [7–10].

During the construction of smart training room, we can refer to the design and configuration of smart classroom. For the training room, the most important thing in teaching is to quickly and effectively convey teachers' experience and knowledge to students, and timely adjust the teaching content and methods through students' feedback. Therefore, the projector or teaching whiteboard is a vital display equipment in practical teaching. Compared with traditional projectors, the display effect of smart screen is better. It can be connected with students' mobile phones to realize interactive teaching, and can feed back students' learning status to teachers in real time. At the same time, it has the functions of projection and whiteboard, which is more suitable for current teaching needs. In addition, the smart training room should have the function of face recognition, which can realize batch face recognition check-in, dynamically capture students' expressions, and realize the feedback of learning effects.

### 3 Function Analysis of Smart Training Room Based on Iot Technology

The main purpose of the smart training room based on the IOT technology is to realize the interconnection between people and things, things and things in the training room. So as to comprehensively master the equipment operation state, personnel learning state, environmental state and safety state of the training room. At the same time be able to adapt to the change of teaching mode under the new situation, and realize the function of course recording and live broadcasting. Sensor, RFID and other technologies are used in the data acquisition stage to obtain the information of training equipment, doors and windows and other objects. The short-distance information adopts a combination of wired and wireless transmission mode. Remote information is transmitted and interacted through the Internet and mobile communication networks such as 5G technology.

Because of the big difference on the configuration between the several types of training rooms, this paper studies the function construction based on types. According to the research results in the early stage, the functional design should mainly include equipment management, personnel management, remote control, environmental monitoring, video surveillance, intelligent security, live and recording, etc.

#### 3.1 General Functions

##### (1) Equipment management

Paste RFID electronic labels on the equipment, and write the purchase date, training room, service life and other information into the electronic labels. To realize the informatization of equipment management, such as equipment access, equipment positioning, equipment scrap, asset inventory and other functions.

##### (2) Video surveillance

Install high-definition surveillance cameras in the training room, connect to the unified monitoring platform, realize the real-time monitoring of the situation. Upload the monitoring video to the cloud platform, and set the effective storage period of the video as needed, so as to facilitate access at any time in case of accidents.

##### (3) Intelligent security

By installing temperature sensors, smoke sensors, infrared human body sensors, intelligent access control systems, etc., to realize real-time monitoring of the indoor environment. If any abnormality is found, the relevant responsible personnel shall be informed in time.

##### (4) Live and recording

The surveillance camera has both monitoring and recording functions. During daily teaching, turn on the camera recording function, which can not only upload to the

teaching platform to enrich teaching resources for students to watch and review after class, but also can be used as data for distance teaching. When there is a need for live broadcast, remote live broadcast teaching can be carried out through the camera. In the indoor training room, it can be realized through wired network. Because the outdoor training room doesn't have wired network conditions, 5G modules can be added to realize network connection.

## 3.2 Special Functions

### 3.2.1 Functions of Indoor Rooms

#### (1) Remote control

Through the IOT technology, all equipment can be connected to the central control platform and the unified mobile management platform to realize the remote control function of equipment and facilities.

#### (2) Environmental monitoring

The environmental data are collected by sensors, and the environment is adjusted accordingly according to the data results, so that the indoor environment is maintained in the preset ideal state. Some equipment such as servers need specific temperature and humidity conditions during operation. Through the temperature and humidity sensor, the indoor temperature is sensed in real time, and the air-conditioner is automatically operated to ensure appropriate temperature and humidity. By adding brightness sensors and infrared sensors, curtains and lights can be opened and closed in time to ensure indoor light. When someone enters the training room at night, the light will be turned on automatically to prevent collision, etc.

#### (3) Personnel management

Complete attendance by collecting personnel information through face recognition equipment. Effectively prevent proxy signing, missing signing and other phenomena. And timely find out the students who are not on duty, so as to timely contact and communicate with counselors to ensure the personal safety of students. Through multi face facial expression recognition, analyze the learning status of students in each period. After class, the analysis results of this class are given in the form of charts. Teachers can focus on some contents according to the results, and also provide data support for future teaching.

#### (4) Intelligent teaching

In the indoor training room, multiple touch smart screens are used to replace the traditional projectors to enhance the picture definition, improve students' participation in the classroom, create interactive, interesting and intelligent classes, and improve the teaching effect and learning quality.

**Table 2.** Function design of smart training room

	Digital simulation	Mixed simulation	Physical simulation (indoor)	Physical simulation (outdoor)
General function design	Equipment management, video surveillance, intelligent security, live broadcast recording			
Classification function design	Remote control, environmental monitoring, personnel management, intelligent teaching			——
	Unified teaching platform		VR training room	

### 3.2.2 Functions of Digital Simulation and Mixed Simulation Training Rooms

Since both digital simulation and mixed simulation training rooms adopt computer simulation system. A unified teaching system and management platform can be used in this kind of training room. To view the learning progress and trajectory of each student in the system, generate everyone's learning report, and guide future learning.

### 3.2.3 Functions of Physical Simulation Training Rooms

The training operations in the physical simulation training room are all completed on the actual equipment, so it's impossible to complete self-study and consolidation after class. In the physical simulation training room, VR and other technologies are used to simulate the actual work scenes and activities. So that students can complete the corresponding operation exercises without going to the scene. At the same time, it can also provide distance education and services, and realize physical simulation distance teaching.

In general, the smart training room based on IOT technology is to build a unified teaching management platform and mobile app in the training room. To realize the construction of smart training room based on IOT technology, RFID, sensors, 5G, VR and other technologies. As shown in Table 2.

## 4 Conclusions

Through the classification research of the training room, this paper combs the construction of equipment and smart classroom, and gives the functions that the smart training room should have in the IOT environment by category, so as to better serve the training of technical talents. Next, we will study the scheme design and technical means of various functions, platform, terminal architecture and network planning, and formulate a set of reference standards for the construction of smart training rooms with strong versatility.

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