



# Construction of Virtual Studio Production System for Online Open Courses in Colleges and Universities

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**Abstract.** Under educational informatization, colleges and universities actively participate in constructing online open courses, and the construction of a digital course production system is necessary to support. This paper discusses the virtual studio production system's design principles and construction plans for online open courses in colleges and universities. It aims to provide a reference for constructing virtual studio production system for online open courses in other colleges and universities.

**Keywords:** Colleges and Universities · Online Open Courses · Virtual Studio Production System

## 1 Introduction

In recent years, large-scale online open courses have emerged rapidly at home and abroad. The development of information technology has made resource sharing the norm, and technological changes around knowledge and learning have brought new opportunities and challenges to the reform and development of higher education teaching. The online open course production system in colleges and universities is an essential basis for expanding the sharing of high-quality resources, which can accelerate the construction of online open courses and accelerate the level of education modernization. Virtual studio technology uses [1] camera tracking technology, computer graphics, image processing technology, and keying blue(green) screen technology. The picture captured by the camera is synthesized with the three-dimensional computer scene to realize the combination of virtual and real, which is conducive to improving teaching efficiency and creating an experimental teaching atmosphere that fully combines practical teaching and innovative practice. Virtual studio production has the advantages of saving video production costs, improving visual performance, improving course quality, convenient use, flexible operation, saving workforce, time resources, and giving full play to imagination and creativity [4]. It has been widely used in producing teaching resources in colleges and universities [3]. This paper discusses constructing a virtual studio production system for online open courses at Jinan University, which is intended to summarize the construction experience and make suggestions for similar colleges and universities.

## 2 Design Principles of Virtual Studio Production System

The virtual studio production system of online open courses in colleges and universities is functionally positioned as an online open course recording platform, which needs to meet the production of courses and has specific expansion capabilities to meet the production needs in the future. Therefore, the system's design should fully consider the attributes of colleges and universities and cannot copy the standards of TV stations and film and television production companies. The system design, characteristics, and production requirements of online open courses should be fully considered according to operational reliability, functional practicability, technological advancement, and system flexibility design principles (Fig. 1).

### 2.1 Principles of Operational Reliability

- The design of the virtual studio production system requires stability, reliability, simplicity, and safety.
- The virtual studio production system needs various ambient temperature/humidity and vibration adaptations.
- The design of the virtual studio production system should have complete online monitoring and management capabilities for signals and equipment, and emergency operations should be safe and fast.
- All kinds of software and hardware should conform to relevant international or domestic standards.

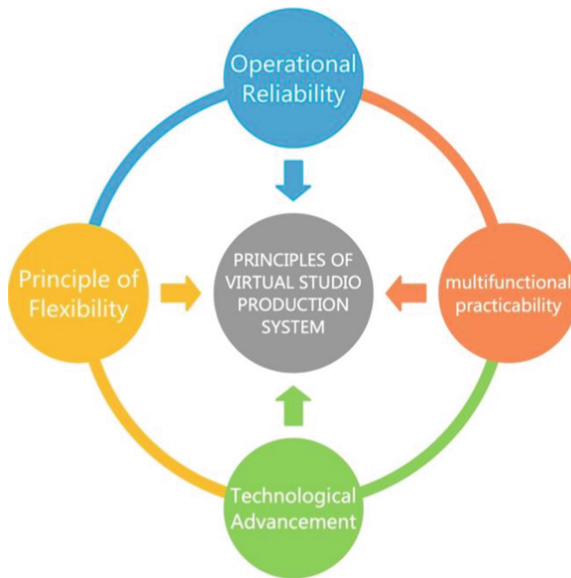


Fig. 1. Design Principles of Virtual Studio Production system

## 2.2 Principles of Multifunctional Practicability

- It can meet the functional requirements of live broadcast and recording of online open courses. In addition, it is necessary to consider other types of courses in the school, such as national-level quality resource sharing courses, micro-courses, and high-quality online courses.
- The system and workstation design should be people-oriented and fully meet the needs of ergonomics, high utilization of space and equipment, and equipment loading distribution, in line with the course production process and operating habits.
- Based on the high-definition core, the system must easily realize the switching and conversion between different formats.

## 2.3 Principle of Technological Advancement

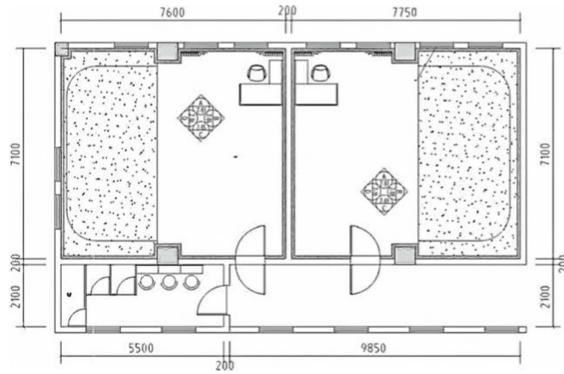
- The design of the virtual studio production system needs to keep pace with international advanced design concepts, adopt an open system architecture, and have strong scalability to meet the requirements of future course production and other television productions.
- The virtual studio production system should adopt equipment with advanced technology, stable and mature.
- It should have 4K program production capabilities, support multi-channel 4K recording capabilities, and be equipped with 4K large-format cameras for external shooting.

## 2.4 Principle of Flexibility

- As a virtual studio production system for multifunctional applications, on the premise of satisfying functions, it should have flexibility in structure, access, and flexibility in operation.
- A virtual studio production system should simple and intuitive operation, flexible signal allocation, convenient maintenance, and management.
- It has scalability, which is convenient for future system expansion and upgrades.

## 3 Construction Content of Virtual Studio Production System for Online Open Courses

An essential part of online open courses is micro-lecture videos. The production of micro-lecture videos requires the support of a virtual studio system and technology. Jinan University built two small virtual studios in Shipai Campus and created a virtual studio in the high-definition multifunctional studio of Panyu Campus, which is the main content discussed in this article.



**Fig. 2.** Virtual Studio Production System Floor Plan

### 3.1 Small Virtual Studio

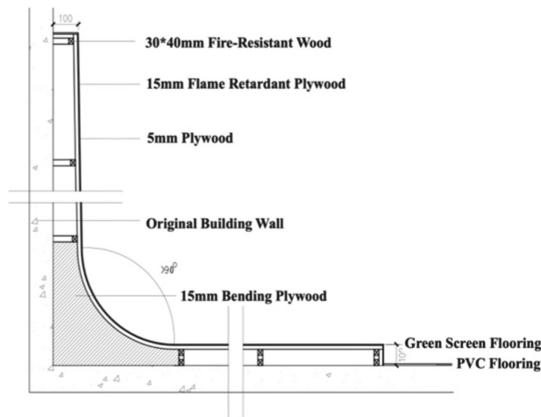
This studio is equipped with a 3-channel full HD virtual studio system, which can use trackless tracking and mechanical sensing tracking, camera tracking technology, computer virtual scene design, chroma key technology, and lighting technology based on traditional keying. Using computer two-dimensional and three-dimensional graphics technology and video synthesis technology, according to the position and parameters of the camera, the perspective relationship of the three-dimensional virtual scene is consistent with the foreground. The imaginary setting is created, and the teacher's teaching activities are integrated with the scene. In a small virtual studio, various micro-lecture videos such as teacher's lectures, expert interviews, and live-action animations can be filmed, edited, and produced. Using small virtual studios to shoot is a relatively economical shooting method (Fig. 2).

### 3.2 Design and Implementation of Virtual Studio System

The virtual keying area is designed with a  $7\text{ m} \times 5.5\text{ m} \times 8\text{ m}^3$  keying green room, which has sufficient space and capacity to meet the camera's push-pull and panning range. The design scheme of the angle between the facade and the platform is more than  $90^\circ$  to reduce reflections. The light reaching the subject can achieve the purpose of uniform lighting and reduce the difference between light and dark. Regarding the proportion of lamps, the ratio of soft light lamps is increased, the heat source lamps are reduced, and the illumination is uniform, providing more creative space for lighting design. In addition, the virtual keying area is equipped with a Wire motor and a Wire pulley set with a load of 400 kg, which provides more possibilities for teaching practice and creation for future teachers and students of animation, film, and film television production.

### 3.3 Decoration Design

The virtual studio system includes a green studio and a blue studio. The renovation consists of three U-shaped facades. The angle between the facade and the platform



**Fig. 3.** Virtual Studio Production system

should be more than  $90^\circ$  to reduce the focus of blue light and sound reflection, making it easier to distribute the light evenly, and the walls will not reflect each other. Rounded corners can help reduce light and dark differences in lighting. The floor should be large enough to avoid strong shadows from the host's face light hitting the facades, which sometimes cause trouble in production (Fig. 3).

### 3.4 How to Build

Usually, the virtual studio system is built with wood and then repeatedly painted, but the wood needs to be pre-treated.

#### 3.4.1 Anti-deformation Treatment

The deformation of the wood is mainly due to the high moisture content in the wood. After a long time, the wood itself will be deformed due to its moisture regain. Therefore, dry wood and plywood should be selected when the wood is selected.

#### 3.4.2 Fire Protection Treatment

Whether the wood meets the requirements of fire resistance and flame retardant is an important issue related to the virtual studio property and the personal safety of the staff. Currently, the fire treatment method used is mainly to spray flame retardant on the wood, and the board is directly selected from the flame-retardant board.

#### 3.4.3 Painting

Repeatedly paint the green room frame 4–5 times with the adjusted blue paint, about 2–3 h apart each time. After completing the green room, the overall color tone remains the same, and the surface is smooth without pinholes, wrinkles, blisters, etc., ensuring that no seams can be seen. The transition between the façade and the curved surface, the façade,

and the floor, and the connection between the curved surface is smooth, without edges, corners, and gaps. The paint color can be selected according to the school's discipline characteristics and personnel composition.

- **Blue:** Blue is more protective of human skin color; blue-edged undertones around objects are less conspicuous than green-edged undertones; actors are happier working in a blue system than in a green or red system.
- **Green:** Most digital cameras capture more information on the green channel, which results in cleaner details on the edges of subjects with less noise and artifacts. A green screen allows the subject to blend into the daytime scene better, giving the composite a more natural look. But green is brighter than blue, reflects more light, has more color bleed, and is tricky in post-production.

### **3.4.4 Floor Protection**

To protect the virtual studio system, you can choose the same color PVC special keyed floor glue for ground protection. The PVC floor has a soft texture and good elasticity and has an excellent elastic recovery under the impact of heavy objects. At the same time, the PVC floor has strong impact resistance and has a solid elastic recovery for heavy impact damage without causing damage.

## **3.5 Acoustic Design and Construction of Virtual Studio System**

The sound pickup of the studio should meet the specific functional requirements while meeting the indoor volume, shape, and size of the functional requirements and suppressing the sound defects that affect the sound pickup quality, such as echo, flutter echo, and low-frequency hum, etc.

### **3.5.1 Sound Absorption Structures**

According to the conductive and reflective characteristics of the high, medium, and low audio frequency, this studio system has designed three types of sound absorption structures. Utilize acoustic cotton, acoustic walls, acoustic panels, and soundproof glass windows, which professionally absorb each frequency band's audio frequency so that the technical room's reverberation time can reach the professional level required.

### **3.5.2 Acoustic Wall and Acoustic Panels**

The acoustic wall adopts a symmetrical design to absorb the sound in the reflective conduction. The acoustic panels adopt a strong sound-absorbing design to significantly reduce the downward reflection rate of the sound, thereby shortening the reverberation time and improving the uniformity of the sound field.

### **3.5.3 Soundproof Glass Windows**

The observation window adopts a double-layer non-parallel sound insulation design, and the door adopts a multi-material composite sound insulation design so that the sound insulation doors and windows meet the sound insulation standards (Fig. 4).

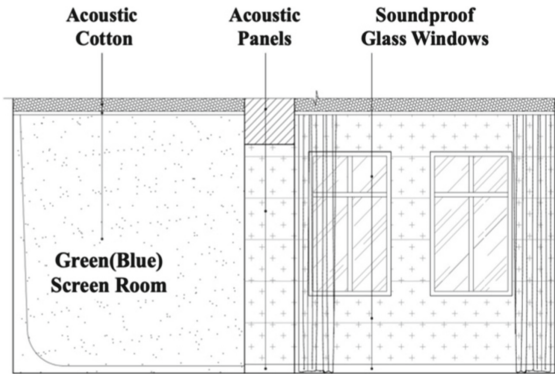


Fig. 4. Virtual Studio Production system

### 3.6 Software Construction of Virtual Production System—HD Virtual Studio System

This virtual studio system is equipped with different high-definition virtual scene systems in different areas. The virtual green studio with a smaller area uses Vision Magic 1300HD, and the larger one uses Vision Magic 2000HD, which can maximize the movement of the camera lens and can realize creativity and scenes within a limited time and budget. Meet various online open courses' recording, broadcasting, and post-production needs.

Full HD scene virtual infinite blue studio could achieve push-pull, pan, rocker aerial photography, and other effects. It uses trackless tracking technology to attain mechanical sensor tracking and increase the layering and realism of the scene.

Channels of digital HD/SD signal (camera), two channels of local multi-format video material, PPT, multi-format pictures, subtitles, one channel of the 3G return signal, and one channel of VGA signal (HD/SD) input, broadcast control and output.

Multiple sets of virtual scene libraries could realize real-time subtitle overlay. They are embedded with hundreds of special effects, which switch between 12-channel virtual cameras, rocker effects, tuning and recording control functions are highly integrated, the system is stable, and the operation interface is friendly, meeting the diversity of programs' stylized, easy-to-operate needs.

It is not only suitable for recording online open courses but also for producing various types of programs such as news, sports, advertisements, etc.

### 3.7 Application of Virtual Studio Production System for Online Open Courses

The virtual studio system for online open courses provides the necessary venues for producing online open courses for teachers and students of the school. It also serves as a shooting venue for promotional videos and theme events and has completed the production of the "Powerful Country Series" and lecture halls. It promotes the construction of online open courses in colleges and universities, promotes the sharing of excellent resources between campuses, promotes the reform of on-campus teaching and the improvement of teaching quality, improves the teaching ability and level of teachers,

improves the quality of education and the level of running schools, and promotes the construction of high-level universities.

The virtual studio system will support the production of online open courses and provide students with a powerful practical teaching and training platform. It will also open a window for them to understand the frontiers of radio and television technology development during their studies in school and to understand all media. Changes in program form and production methods have expanded the way. Most teachers and students experience and practice the recording and shooting of high-definition programs, strive to build a world-class curriculum, and promote talent training in radio and television.

## 4 Conclusions

In the new era, both teaching and learning have undergone major changes. Online open courses have become essential to lifelong learning and teaching reform. The construction and development of high-quality digital education resources cannot be separated from the support of technology and the system. The virtual production system for large-scale online open courses can meet the needs of teaching and research, practical training, promotional video production, online open course production, conference training, program production, and other requirements.

It actively promotes the in-depth integration of information technology and education and teaching, enhances the diversity of shooting forms and content, provides services for teaching and scientific research practice and talent innovation, and improves domestic and international competitiveness. It offers technical support for ideological and political training, external publicity, and technological innovation. It makes more significant contributions to sharing educational resources and the long-term development of higher education.

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## References

1. Dong WSH, Li RQ (2007) Discussion on the construction of virtual studio in colleges and universities. *e-Educ Res* 2:62–64
2. The State Council of the People's Republic of China (2015) Notice of the state council on printing and distributing the overall plan for promoting the construction of world-class universities and first-class disciplines. [http://www.gov.cn/zhengce/content/2015-11/05/content\\_10269.htm](http://www.gov.cn/zhengce/content/2015-11/05/content_10269.htm)
3. Tang Z, Yang GF (2009) The application of virtual studio technology in college teaching. *China Educ Technol* 7:116–118
4. Xie JSH (2017) Research on the creation and management of virtual studios in colleges and universities. *Res Explorat Lab* 12:264–266+28



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