

# Construction of Virtual Communication Experiment Teaching System of Mobile Communication

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**Abstract.** "Mobile Communication" is an important professional course for the electronic information profession. In view of the current status of the traditional "experimental box" experimental teaching of the course, the main problem includes three aspects: the experimental equipment update speed is slow, the experimental content is still based on the verification experiment, and the virtual simulation experiment teaching challenges the traditional experimental teaching.

Virtual simulation experiment teaching has been widely used in many colleges and universities. For the theoretical, practical and technical aspects of mobile communication, and the development of very fast courses, the construction of a set of effective virtual simulation experiment teaching The system has become an inevitable choice to improve the experimental teaching level of the course. The school's mobile communication virtual simulation experiment teaching system can be realized through the construction of the system's overall interface and operating environment construction, mobile communication device model construction and typical experimental design, thus building the "new engineering" professional for the school and "The cultivation of applied talents has been added.

## Introduction

The "Mobile Communications" course is an important professional elective course for undergraduate electronic information science and technology majors. From the perspective of teaching, the course is a comprehensive discipline with theoretical, practical and technical strength and multiple cross-disciplinary nature. From the perspective of discipline development, the field of mobile communication is in the information industry today. The construction focus and research hotspots, the development of communication technology is changing with each passing day. In just 20 years, the mobile communication system has developed from the first generation to the fifth generation. At present, the 5G system has started under the vigorous promotion of Huawei and the support of the Chinese government. Global commercial layout. Experimental teaching is a key node in the teaching of mobile communication courses. Therefore, how to enable students trained in the school to keep up with the frontiers of communication technology, quickly grasp the main points of communication technology, and meet the requirements of jobs as soon as possible after graduation. "Application-oriented" talents need to solve problems.

## Analysis of Problems Encountered in the Experimental Teaching Process of "Mobile Communication" Course

The experimental teaching of the mobile communication course of the school is still based on the traditional "experimental box" experiment, so it has gradually failed to meet the requirements of building "new engineering" major and training "application type" talents, mainly reflected in the following three aspects.

**The Experimental Device update Speed is Slow, and it has Gradually Failed to Keep up with the Rapid Development of Mobile Communication Technology.** As we all know, the rapid development of mobile communication technology is obvious to all. The traditional "experimental box" type teaching has relatively limited experimental content, and the technology covered has certain limitations. Therefore, after two to three years of implementing the experimental teaching, it can be felt that its content has been obviously "backward" to the latest. Application, can not be "advance with the times." Moreover, when the experimental equipment is used for a long time, the aging phenomenon of the equipment will become more and more obvious, which will have obvious adverse effects on the results of the experiment. If the equipment is updated, it will bring great financial pressure. Frequent updates to experimental equipment are unrealistic.

**The Experimental Content is still Based on Confirmatory Experiments, Lacking Transparency and Creativity.** The "experimental box" type of experimental teaching is generally equipped with an experimental instruction book that is matched with the experimental box. Students only need to follow the drawing of the experimental instruction book to connect the lines, operate according to the experimental steps, and observe the experimental results by using the corresponding instruments. This is to write and submit an experimental report. The content of the experiment is still based on confirmatory experiments. There are few creative experiments in which students independently design experimental objectives, experimental procedures, and personally verify the experimental results. Although this can guarantee the quality of the experimental process and prevent students from making unnecessary mistakes, it also neglects the cultivation of students' innovative ability. Moreover, since the experimental boxes are basically fully enclosed, students are simply unable to have a perceptual understanding and understanding of their internal working mechanisms, and thus cannot meet the requirements of cultivating "application-oriented" talents.

**The Challenge of Virtual Simulation Experiment Teaching to Traditional Experimental Teaching.** With the continuous maturity and progress of virtual simulation technology, virtual simulation experiment teaching has been widely used in many universities. It has many obvious advantages compared with traditional experimental teaching. For mobile communication, the main advantage is Reflected in the following aspects:

Make the experimental process of the mobile communication system transparent and controllable. The virtual simulation experiment method can display some complicated experimental procedures safely and intuitively, especially making the signal transmission process within the system accessible and controllable, which is very effective for students to deeply understand the basic theory of mobile communication systems.

Relieve the update pressure of large-scale experimental equipment for mobile communications. The virtual simulation experiment method has unparalleled advantages in terms of cost, difficulty and cycle in updating and expanding the upgrade compared with the traditional "laboratory box" teaching, which can save the school a lot of money.

Can meet the needs of distance education. The virtual simulation experiment method can provide students with an open and visual operation platform by means of the network. Students can start experimenting on the "independent" Internet without having to concentrate on a special experimental classroom. In this way, the student can not only perform repeated experiments to exercise the experimental ability, but also provide the necessary resources and a good environment for the students to independently design the experimental process and verify the experimental results<sup>[1, 2]</sup>.

### **The Specific Construction Objectives of the Mobile Communication Virtual Simulation Experimental Teaching System**

The construction of the mobile communication virtual simulation experiment teaching system of the school can be realized through the construction of the following three links:

**System Overall Interface and Operating Environment Construction.** The experimental operation platform interface designed by this system includes the experimental platform, equipment manager, user manager, experiment library,

menu bar and tool bar.

In order to facilitate management, the system server users are divided into four roles: student, teacher, educational administrator and system administrator. Different roles have different permissions.

1. Server operation environment construction

Operating system: Windows Server, Linux/Unix Server

Web server: Tomcat6.0, JDK6.0

Database: MySQL

2. Client operating environment construction

Operating System: All Windows Series

Through the experimental operation platform interface provided by the system, the registered four roles (student, teacher, educational administrator and system administrator) can be reasonably logged in and use the internal resources of the system to provide a good simulation for subsequent experimental operations. surroundings.

**Mobile Communication Device Model Construction.** The mobile communication device models that this system needs to build are divided into six categories:

1. Sequence module library

2. Sequence operation module library

3. Encoding/decoding module library

4. Modulation / demodulation module library

5. Experimental dedicated module library

6. Analysis and Drawing Module Library

Through the six major types of device models provided by the system, the teacher can smoothly complete the teaching process of eight typical experiments of the mobile communication course required by the "application type" undergraduate talent training, and also allow the teachers to independently design the typical experiment of the specialization. It allows students to independently design, verify and complete a personalized experimental process, laying a solid foundation for improving the effectiveness of experimental teaching and training students' practical ability.

**Typical Experimental Design.** The system needs to design 8 typical experiments to meet the needs of the course teaching practice. Specific experimental projects can be designed as:

1. Random sequence generator design

2. FSK modulation and demodulation process

3. Spread spectrum despreading process of FSK signal

4. Convolutional code encoding and decoding process

5. The function of the receiver's same branch

6. Receiver lead and lag branch functions

7. GSM communication system simulation

8. CDMA communication system simulation

Since the original intention of the system construction is to enhance the transparency and creativity in the experimental teaching process of the mobile communication course, the above experimental project content is only used as a reference for the instructor and the elective students. The system is more inclined to encourage students to conceive and verify various personalized design schemes according to their own ideas, and complete the whole process of experiments independently, so as to fully display the creative thinking of students and make students feel the joy of learning.

## **The Concrete Construction Content of the Virtual Communication Experiment Teaching System of Mobile Communication**

The school's mobile communication virtual simulation experimental teaching system construction content can be subdivided into the following four aspects:

**The Functions Implemented in Each Part of the Experimental Operation Platform Interface.** The functions to be implemented in each part of the experimental operation platform interface are as follows:

Experimental platform: In this area, set up experimental equipment, carry out experimental operations, and perform calculation results.

Equipment Manager: Provides the equipment to be used in the current experiment. Use the icon of the equipment and the corresponding description text to display and explain.

User Manager: Provides user information, user actions, and thumbnails of current experiments.

Experiment Library: Provide users to view current experimental devices, built-in experiment manager, and remote experiment manager.

Menu Bar: Provides file management, user management, lab runs, views and help.

Toolbar: Provides a zoom of the shortcut keys of the menu bar using the tool and the experimental platform.

**The Rights of the Four Roles of Students, Teachers, Educational Administrators and System Administrators.** The four roles that students, teachers, academic administrators, and system administrators are intended to have are specifically designed to:

Students: Select courses, select experiments, conduct experiments, receive experimental guidance, submit experimental reports online, save and submit experimental results, query experimental results and comments<sup>[3-5]</sup>.

Teachers: The typical experimental library maintains, publishes experiments, arranges experiments, corrects experimental reports, systematically guides, counts and publishes students' experimental scores and comments.

Academic administrator: Course plan, start plan, course selection date, start class review, class start inquiry.

System administrator: User management, group management, role management, rights management, system maintenance, etc.

**The Specific Composition of the Device Model.** The modules included in the six major device models to be built by this system are as follows:

### 1.Sequence module library

Sampling pulse sequence, step sequence, rectangular sequence, real exponential sequence, sinusoidal sequence, pseudo-random sequence (m sequence, Gold sequence)

### 2.Sequence operation module library

Sequence addition, sequence convolution, sequence accumulation, sequence deconvolution, sequence multiplication, sequence translation, sequence delay, sequence modulo 2 and

### 3.Encoding/decoding module library

Waveform coding, parameter coding, linear block code, cyclic code, convolutional code, interleaved coding, Turbo code

### 4.Modulation / demodulation module library

Amplitude Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Gaussian Minimum Shift Keying (GMSK), Quadrature Phase Shift Keying (QPSK), Quadrature Amplitude Modulation (QAM) Orthogonal Frequency Division Multiplexing (OFDM)

### 5.Experimental dedicated module library

Random sequencer,FSK modulation/demodulation,direct sequence spread/despread, receiver, phase-locked loop, Gold sequence generator, read external data (txt) file, data write to external file

### 6.Analysis and Drawing Module Library

System amplitude-frequency response, system signal-to-noise ratio, system carrier-to-interference ratio, signal pin diagram, signal waveform diagram, signal spectrum diagram, signal fading characteristic curve, signal power spectrum, time slot/frame structure diagram

**Typical Experimental Design.** Compile a set of mobile communication instructions for the virtual simulation experiment system.

## Summary

The school's mobile communication virtual simulation experiment teaching system consists of two parts: the course experiment simulation platform and the virtual experiment teaching management system. The simulation platform adopts the equipment and equipment used in the virtual machine technology simulation experiment to provide an experimental environment similar to the real experiment. The virtual experiment teaching management system provides a full range of virtual experiment teaching auxiliary functions, including: pre-experiment preparation and experimental start-up Management, maintenance of typical experimental libraries, experimental teaching arrangements, guidance of experimental procedures, revision of experimental results, statistical query of experimental results, etc., provide services and applications for the experimental teaching environment, especially for distance learning<sup>[5-7]</sup>.

The school's mobile communication virtual simulation experimental teaching system can build a new experimental environment, enrich the experimental teaching form, and facilitate the management of the experiment for the school; it can provide rich device models and typical experiments for teachers and students, support personalized experimental design, and cultivate The students' innovative thinking and creativity can reduce the construction cost of the laboratory and reduce the construction period of the laboratory, thus contributing to the construction of the “new engineering” profession and the cultivation of “application-oriented” talents.

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