Construction of Practical Teaching Platform for Mobile Communication System Under Big Data

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Abstract. Aiming at the problems existing in the practical teaching of mobile communication system, a practical teaching platform of mobile communication system is established, which combines the computer LAN under the background of big data as the transmission carrier, supplemented by virtual signaling and business link interface. The platform fully simulates all the functions and signaling process of the actual communication system, so that students can not only master the structure framework of the whole mobile communication system, but also master the workflow and signaling process of the communication system. At the same time, the platform can also provide secondary development and other functions to enhance students' design and development ability.

Keywords: Big data background · Mobile communication · Teaching platform

1 Introduction

At present, many colleges and universities have set up the major of communication engineering [1]. Under the current situation, the Ministry of communications attaches more and more importance to the practice of teaching. Experiment is a very important part of practice, which can arouse students' learning enthusiasm, give full play to students' subjective initiative, and cultivate students' rigorous and realistic scientific attitude.

Higher vocational education must take the improvement of quality as the core, reform and innovation as the driving force, continuously deepen the reform and accelerate the development, so as to make the higher education have a new improvement in the quality of personnel training, a new breakthrough in the school running system and mechanism, a more reasonable structure layout, and an increasing social service ability, so as to realize a historic leap forward in the connotation development.

Undoubtedly, the conference pointed out the core issue of the construction of educational connotation the deep integration of school and enterprise. The deep integration of school and enterprise is an important means for higher vocational colleges to deepen teaching reform, improve teaching quality and serve local economy. The key to the success of the deep integration of school and enterprise is to form a unique, post oriented and systematic practical teaching system based on working process.

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2 Construction of Practical Teaching Platform for Mobile Communication System

In view of the problems existing in the existing communication experiment and the rapid development of computer technology, it is necessary to reconstruct the communication experiment teaching platform through software simulation with the help of computer software virtual technology. Inspired by this, we simulate various functional entities including MS (mobile station), visitor location register (VLR), home location register (HLR), media gateway MGW (media gate way) and MSc server (mobile switching center server) through software virtual technology, With the help of virtual signaling and service link interface, a complete mobile communication system practice teaching platform is constructed by using computer LAN as transmission carrier. Relying on this platform, students can intuitively "touch" the structure and working process of mobile communication system, and let students establish the overall concept of mobile communication system [2–4]. In addition, communication students establish the overall concept of mobile communication system. In addition, through the development of relevant experiments on the platform, students can transfer the experiments of independent knowledge points done in the experimental box to this platform. By integrating the experiment of independent knowledge points into this platform, students can understand the influence or role of each independent knowledge point in the whole mobile communication system, deepen the understanding of distributed knowledge points, and consolidate the overall concept of mobile communication system.

From Fig. 1, it can be seen that from 2014 to 20120, the construction of big data platform of national universities is on the rise, so we know that this scale must be very large.

Fig. 1. Scale of big data platform

2.1 Software Design of Mobile Communication System Practice Teaching Platform

Consider a set of ergodic band limited functions with the highest frequency of W cycles/s. Let the distribution density function of amplitude of n continuous sampling points be as follows:

$$p(x_1, \cdots, x_n) \tag{1}$$

The entropy (per degree of freedom) of the system set is defined as:

$$H^{'} = -\lim_{n\to\infty} \frac{1}{n} \int \cdots \int p(x_1, \cdots, x_n) \log(x_1, \cdots, x_n) dx_1 \cdots dx_n \tag{2}$$

We also define an entropy H (per second), which is divided not by N, but by the duration t (in seconds) of n samples.

When the noise is Gauss white thermal noise, there are:

$$H^{'} = \log \sqrt{2\pi eN} \tag{3}$$

$$H^{'} = \log 2\pi eN \tag{4}$$

For a given average power n, the entropy of white noise is maximum. This is derived from the maximization property of the Gaussian distribution given above.

2.2 Open Compound Talents Training

1) The teachers of the course group publicize some independent knowledge points in the scientific research to the students and allow them to carry out their own research. Students can also directly participate in the scientific research of cooperative projects and obtain the training of scientific research ability and scientific research management.
2) The curriculum team of international teacher team training mode sends teachers and students to Hong Kong, Europe, the United States and other universities to listen to teachers' lectures, exchange with overseas students, invite famous overseas professors to teach, offer lectures and offer new courses [5–7]. These measures not only improve the quality of teachers, but also open up students' knowledge vision, and play an important role in students' all-round development. Through the construction of multi-layer and multi-mode open "mobile communication system" practice teaching new mode, the course group has completed the seamless, smooth and compound talent training for students, and achieved a series of teaching research results. Over the past five years, the course team has published hundreds of papers, compiled 8 works and applied for more than 100 patents, of which 31 have been authorized. Through the cultivation of multi-level practice teaching, students improve their practical ability [8].The construction of curriculum and teaching materials has been fruitful. The course of "mobile communication system" in our school was rated as the excellent course of Sichuan Province in 2010. In 2006, the textbook

of modern wireless and mobile communication technology was completed, and the upgraded textbook of mobile communication system and network was completed in 2012. The course group has also compiled textbooks on related topics, mainly including spread spectrum communication in 2002, differential frequency hopping communication principle and application and modern coding theory and application in 2007, and Iterative Equalization Technology in wireless communication in 2011. In addition, the course group has compiled three editions of the guidance book of mobile communication system experiment for the developing practical teaching system of mobile communication system.

3 Realization of Software Platform and Simulation Analysis

Realization of Software Platform

1) Low cost, high reliability
   The platform is implemented by software, its new cost and update cost are far lower than that of hardware platform, and its reliability and stability are better than that of hardware experimental platform [9, 10]. After the technology is updated, only the software module of the corresponding network element needs to be updated, which greatly reduces the update cost of experimental equipment.
2) Normative
   The program design adopts modular and layered design. Different modules such as network transmission, signaling processing, voice processing and interface display are designed independently with clear and standard levels.
3) Support multi-user and multi task
   In this simulation software platform, it can support multiple students to participate in the operation and observe the operation effect independently.
4) Expansibility
   After the virtual simulation platform is built, many mobile communication system related experiments can be developed based on this platform. For example: SMS codec experiment, channel codec experiment (such as convolutional coding, Viterbi decoding experiment), interleaving and deinterleaving experiment, at instruction experiment and SMS Gateway experiment.
5) Support multi format
   Simulation of mobile communication systems (csmcdma, LTE, etc.) supported by the platform in parallel.
6) Consistency
   The configuration method or parameters of the platform should be consistent with the actual mobile communication system; the operation interface should be beautiful, and the operation methods and habits should be close to the reality [11–13]. For example, when the mobile station function simulation entity is implemented, the operation interface of the mobile station is consistent with the actual mobile phone, and the interface is beautiful and generous.

7) Integrity (macro)
Whether it is communication process demonstration or system control, or development experiment, students can see the operation process of "overall" platform, so as to better and more clearly understand the overall structure, working process and principle of mobile communication system, and organically connect the independent and scattered knowledge points in the theoretical teaching in class.
8) Simple maintenance
The simulation experiment software platform is realized by using mature computer LAN technology and computer software. The structure is simple and clear, and it is easy to maintain. Compared with B/S (Browser/server) mode, RCP provides more powerful functions for users through plug-in development [14, 15]. By using SWT (standard widget Toolkit) to design U form and extending GEF (graphical editing framework) plug-in to process graphics, the interaction between users and applications is greatly improved. Oracle database is used for data storage. Oracle 9 is a powerful object-oriented database oriented to Internet computing environment, which changes the way of information management and access. Oracle complies with the industrial standards of data access language, operating system, user interface and network communication protocol; supports high-performance transaction processing of large database and multi-user; implements security control and integrity control, which provides technical guarantee for data security.

3.1 Simulation Analysis

We selected the data of communication data platform from February 1 to March 4, as shown in Fig. 2. From Fig. 2, we can see that in these platform cycles, with the increase of time, the platform construction data shows an upward trend, but there is a fluctuating trend. This shows that the platform data is unstable. But from another aspect, we can know that in the construction of this platform, the external data we use is inconsistent, which leads to this situation. In the past five years, the curriculum team has established contact with well-known universities at home and abroad, exchanging teachers and students and

Fig. 2. Communication data platform data

academic exchange [16]. There are 12 teachers in the course group, accounting for 80% of the total number. The course group has received many foreign professors. And sent many teachers and students to attend the international conference. The course team has carried out a number of project cooperation with well-known enterprises at home and abroad, including Intel, DoCoMo, Samsung, Huawei and ZTE, to provide students with all-round opportunities to participate in scientific research.

4 The Design Idea of Practical Teaching System

4.1 Construction of Practical Teaching System

4.1.1 Construction of Ideas

In the construction of practical teaching system, the hierarchical and progressive system structure is designed, following the practical teaching training idea of "basic knowledge learning ability training competition strengthening", that is: first, solid basic knowledge learning, on this basis to strengthen the ability training, and finally through participating in various subject competitions to improve students' practical and innovative ability. For the learning of basic knowledge, the basic experiment module is designed, including verification experiment based on "communication principle comprehensive experiment box", design experiment using DSP, arm and FPGA respectively [17]. Through the communication principle experiment box, students can verify the basic modulation and demodulation principle, encoding and decoding technology, system performance analysis and other theoretical knowledge in the point-to-point communication system, It is realized by the development system of ν SP, FPGA and arm [18]. Aiming at the cultivation of strengthening ability, the system simulation experiment module is designed, including the communication system simulation experiment based on ssystemview 5 and the communication system simulation experiment based on MATLAB 6. As shown in Fig. 3. The communication system from simple to complex is designed through the software simulation platform, In the application-oriented experiment module, including software radio experiment and CDMA mobile communication system experiment, more complex modulation and demodulation and encoding and decoding technology are realized in software radio system, It can touch the structure and working process of the actual system, exercise hands-on ability, and finally select excellent students to participate in various competitions to improve students' scientific and technological innovation ability.

4.1.2 Design of Practical Teaching System

The following points are highlighted: (1) each module is not only connected with each other, but also has its own system, supporting the corresponding theoretical teaching content, combining basic experiments with comprehensive and designed experiments, combining modern teaching methods and means such as multimedia technology, virtual technology and network technology, and making full use of advanced and colorful experimental teaching resources, Combined with guiding students to compete in electronic design and self-made instruments and equipment, teaching, discussion, independent experiments, in class and out of class experiments are combined to develop students'

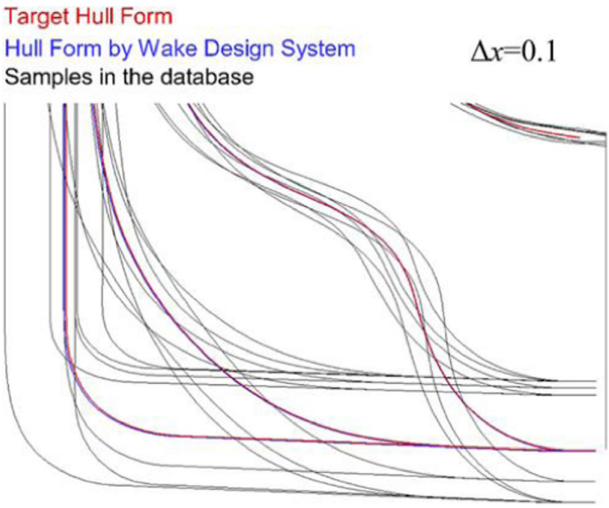

Fig. 3. Target system of practice teaching.

ideas and cultivate their innovative spirit; (3) in the course architecture design, each module is designed step by step, from simple to complex, from basic to comprehensive, from design to innovation, and at the same time, it takes into account and radiates other related majors, For example, students of non electrical majors are recommended to do the confirmatory experiments in the basic experiment module and system simulation module, students of electrical non communication majors are recommended to do the basic and system simulation experiment module, students of communication majors can choose the three modules in turn, and students with good foreign language level can choose bilingual teaching MATLAB and communication simulation experiment [19]. It can also be used as an open experiment and postgraduate experiment project. (4) The design of experiment content is closely related to the training goal of application-oriented talents, highlighting the cultivation of students' engineering practice ability and professional ability.

4.2 Practical Teaching Target System

Firstly, through the hierarchical and progressive architecture, it helps students to establish the overall concept of the communication system; secondly, through the verification, design and comprehensive experiments, it helps students to establish a comprehensive and multi-level understanding of the communication system from the overall architecture to the specific modules and the corresponding key technologies, It plays a positive role in promoting the cultivation of students' engineering practice ability and professional ability; finally, it cultivates students' ability to comprehensively use basic communication knowledge and experimental technology, so as to meet the needs of cultivating high-quality engineering application-oriented talents of communication and information [20]. In the experiment of DSP and FPGA development system, students can design the core functional modules (such as fr filter, 2fs κ module, etc.) in the communication

system, and selectively build the basic communication system to organically combine theoretical knowledge with practical ability. In the system simulation, students can design the communication system (such as FM system, PS κ system, etc.) by using Systemview software simulation platform, Or with the help of MATLAB software simulation platform to analyze the performance of the system (such as am system, PCM system, etc.), so as to further deepen the understanding of the communication system. In software radio system, more complex communication technologies can be realized, such as GMSK demodulation technology, wireless multipath channel characteristic experiment, etc., On the CDMA mobile communication system, we deeply understand the architecture and workflow of the actual mobile communication system through engineering practice. Finally, by organizing students to participate in all kinds of competitions, students can apply and strengthen their knowledge and practical skills, so as to achieve the teaching goal.

4.3 The Effect of Practice Teaching System

(1) It can stimulate students' innovative consciousness, improve their comprehensive practical ability and scientific research quality, and become the enlightenment education of scientific research [21, 22]. After entering the graduation thesis and graduate stage, the students' scientific research ability is highly praised by the tutors. (2) stimulate the students' interest in communication basic experiment and system experiment. In recent years, more and more non communication majors have taken this course, and some students have taken advantage of their spare time or summer vacation to further expand their experiments in the laboratory. (3) many students have won national and provincial awards in the National Undergraduate Electronic Design Competition and Challenge Cup competition: (1) in 2007, they participated in the National Undergraduate Electronic Design Competition, He won 1 first prize and 4 third prizes in Shaanxi competition area; ② he won 1 first prize in Shaanxi competition area in 2008; he won 1 s prize in national embedded competition of national Bo Chuang cup; ③ in 2009, he won 1 s prize in national challenge cup, 1 first prize in Shaanxi and 1 s Prize in Shaanxi; he took part in NoC college students' science and technology innovation competition, He won one national first prize and the highest trophy; he took part in the National Undergraduate Electronic Design Competition and won one second prize in Shaanxi competition area.

5 Conclusion

The mobile communication practical teaching platform introduced in this paper can realize the connection between communication basic courses and communication professional courses, and directly apply the coding and decoding technology in the basic courses to the overall system of mobile communication. In the aspect of communication technology, the system control from terminal, wireless air interface and signaling, base station, VLR, HLR and network exchange is completed. Students can not only master a specific technology, but also grasp the whole network architecture and communication system. The design and development of mobile communication engineering training simulation system make full use of modern information technology to develop a virtual

training environment covering the whole process of mobile communication engineering, which provides an effective way for students to combine theory with practice before practical operation. It can enable students to have a comprehensive understanding and understanding of the basic principles, key technologies and typical systems of mobile communication, strengthen the engineering practice ability, cultivate students' systematic thinking, analyze and solve the relevant problems in the mobile communication system, and lay the necessary foundation for the practical mobile communication system engineering construction, maintenance, management, learning of new knowledge and research of new problems. At the same time, the system can also carry out pre job training of mobile communication basic skills for the marketing, service, management and equipment maintenance personnel of mobile communication business department.

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