Study and practice in the construction of open physical experiments teaching system

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Abstract: Based on open physical experiments teaching system put forward by Ministry of Education, HHU(Hohai University) has carried out the construction of open experimental manage system, which includes course selecting system, teaching system, manage system and information desk. The innovation is in order to mobilize the students' learning autonomy, cultivate the students' creative ability and improve teaching quality. Besides, it achieves direct management from school to college to the laboratory and traced manage to the working device regardless of distance and time.

1. Introduction

The open experimental teaching model is a new practice teaching mode promoted by the Ministry of Education in Colleges and Universities. At present, there is no mature and unified Open Experimental teaching mode in china. To sum up the common points of the current situation of the domestic colleges and universities, Open Experimental teaching mode, mainly in the teaching content, teaching time to provide students with their choice of space. The open experimental teaching platform software in China also develops corresponding functions according to this model. It is generally divided into courses arrangement, elective function, multimedia teaching function, attendance scoring function and information publishing function. Our open experimental teaching platform in addition to the above functions, but also the design and development of asset management functions, from school to college to the vertical management of the laboratory, with the authority of users regardless of distance, regardless of the time period at any time on the line of the equipment being used for tracking management.

2. Open Experimental Management System

The open experiment management system is divided into two parts:software and hardware. The software part can be divided into experimental teaching module, teaching management module and asset management module according to the function. There is also an integrated database for managing the relevant data and index relationships stored in each module. The hardware part includes an all-day work server, a certain number of PC client computer, LCD TV or projector, digital camera, according to the needs of the client can also use intelligent mobile phone, tablet computer and information terminal products. The connection between the server and the client is through the wired or wireless network. If necessary, some functions can also be used in the mobile communication network. The client can be divided into three kinds of administrators, teachers and students in accordance with the use of permissions. The client interface is mainly divided into three types: direct use of web browser login web page mode, PC computer application program based on VC programming language development and in the intelligent mobile phone, tablet computer according to the corresponding application mode of different equipment operating system development.

2.1 Course Selection System
The system is mainly used for teaching managers to arrange courses and students choose courses. The contents of the course arrangement include the experiment items, the time of the course, the number of teachers, the arrangement of the teachers and the setting of the system parameters. The development mainly uses database technology and ASP dynamic web technology. The key of this part is to set up the various fields of the database and the relation among them. Optimize batch repeatability in class scheduling to improve efficiency. The key technique of student selection is the concurrent access control of database. At least 1000 users are required to access and submit data at the same time without overflow error.

2.2 Teaching management and Asset management system
Teaching management is mainly in the classroom to students holding two-dimensional bar code to identify attendance, after school students submitted to the experimental report, through two-dimensional bar code index, and enter the results. The asset management system mainly identifies the one-dimensional bar code labels on the fixed assets. The key to these functions involves the identification of barcodes. The main technology used is digital image processing technology. It is necessary to ensure that the camera can recognize the image content accurately and quickly under various illumination conditions. Cameras are generally required to enter from the bar code to the automatic focus, less than one second.

2.3 Teaching demonstration system
The main equipment is a large size LCD TV and a tablet computer with camera and wireless network function. As a display device, Liquid crystal TV is necessary to install a wireless receiver at its input, synchronous display of the contents of the tablet computer screen. The tablet PC can play multimedia files stored in the computer, and also can broadcast the teaching video on the server through the network. Moreover, the tablet PC can also use the integrated camera to shoot video in real time. The key technologies of this part is multimedia technology and wireless data transmission technology.

2.4 Hardware device
(1) Software technology: Design Server database mainly uses database technology; the client using VC programming technology, Java programming technology, digital image processing technology; in addition, the use of multimedia technology, Flash technology and the teaching content of video and animation.
    (2) CPU: Intel Xeon E5506 X1, up to 4.
    (3) Memory: 8G up to 64G.
    (4) Hard disk: 1TB, SATA, X2, built-in, can install 6 plates, maximum 12T.
    (5) Other: CD driver, Dual Gigabit Ethernet card, Tower type.
    (6) CPU: Intel dual core 1.6G.
    (7) Memory: 2G.
    (8) Hard disk: 500GB.
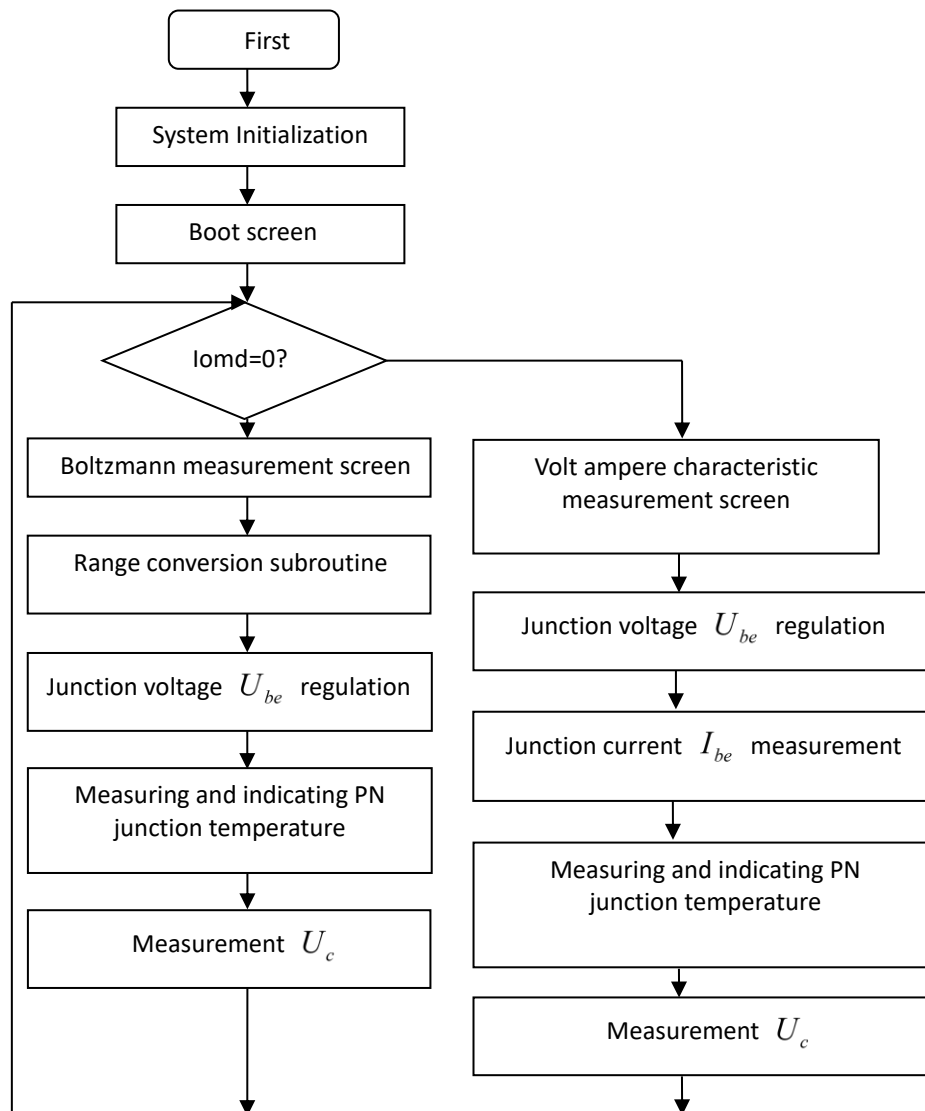   (9) Other: CD driver, Gigabit NIC, 8 million pixel camera.

Figure1. System master program flow chart

3. Innovation of open experiment management platform system

Bar code as   m, m m identity identifier, using digital image processing technology, through the computer, mobile phone camera, manage teaching system and achieve statistics of students, manage laboratory fixed assets. After selecting the students, a unique two-dimensional barcode is generated according to the student's number, the selected experimental items and the experimental date. The user will download and print the two-dimensional bar code on the experimental report paper. In class, students are identified and checked by the client computer in the classroom or the camera on the mobile phone. After the student's experiment report is corrected by the teacher, the camera is used to identify the bar code, locate it to the specific student, and input the result into the database. In fixed assets management, all registered fixed assets have a unique number, according to the number to generate a one-dimensional bar code, will be attached to the bar code stickers affixed to the device. When a user holds open client terminals such as intelligent mobile phone, tablet computer in hand, enter the room number, and then enter the working state of the equipment room of each scan and select equipment, the client information through wired / wireless network or mobile network traffic sent to the server, you can update the instrument location and status. The asset management departments at

various levels can keep abreast of the working conditions of equipment in the register by querying the database.

The use of tablet computer teaching demonstration is more in line with the teaching characteristics of experimental teaching. Using computer and projector traditional multimedia teaching, this project uses the tablet computer and LCD TV, wireless network connection between the use of the utility model has the advantages of small size tablet computer in hand, on the spot demonstration experimental teachers can move freely, convenience of the instrument; the touch screen operation, than in the demo the mouse is more convenient; the tablet computer integrated camera, the demonstration apparatus in detail, can be taken from different angle and different distance using the camera, shooting content simultaneously displayed on the LCD TV. The price of the LCD TV is basically the same as that of the projector and curtain, and there is no need to replace the bulb. In the long run, maintenance costs are lower.

Open Experimental Management Platform System

(1)Database technology is a mature technology, the data throughput of database system using the system is not large outside the steady state in the unit of time in some special periods (such as open elective system for the first 1 days), It can limit the number of concurrent access method in a special period of time to ensure that the database can work normally.

(2)Digital image processing technology is a mature technology. Bar code identification is a mature application of array image processing. The technology has many applications in industrial generation, commercial, security and other fields. And the bar code identification environment is relatively good, the success rate is very high.

(3)Wireless transmission technology is mature technology. The wireless transmission technology in this system is mainly used in the communication of client and server, the image transmission of tablet PC and LCD tv. Among them, the client and server communication information is small, and the video transmission between the tablet PC and LCD TV is larger. Considering the current screen resolution of the tablet PC is generally 720P, the amount of video transmitted per second is much smaller than the current transmission rate of wireless network card 300Mbps.

(4)The key technologies of equipment sub project in this system are mature technologies, which fully meet the current teaching requirements. The system has the advantages of clear method, clear content, small power consumption, small volume and low cost, and can meet the teaching purpose of a large area.

4. Conclusion

Open experimental teaching is the opening of time, space, teaching content, teaching methods and teaching means, and it is also the development of concept consciousness. To create a good external environment for students' active learning and personality development, to meet the desire of students to seek knowledge, exploration and innovation, cultivating students' practical ability, independent thinking, analysis and solve the problems of knowledge ability, comprehensive use. It is beneficial to give full play to the guiding role of teachers, the students' subject learning role and the interactive mode of teaching, so as to effectively solve the problems existing in the current experimental teaching.

Reference

[1]   Xu Jing, Hu bin. Preliminary research on open innovation experimental teaching reform [J]. Laboratory Research and Exploration, 2002,21 (5): 21-22.
[2]   Chen Xucheng. Practice and Research on establishing a high level experimental teaching demonstration center [J]. Laboratory Research and Exploration, 2007,26 (4): 93-94.
[3]   Ma Jing. Discussion on open teaching mode of college physics experiment [J]. Physical Experiment of College, 2011 (8): 93-96.
[4]   Li Haijin. The exploration and practice of Cultivating College Students' independent thinking ability in college physics experiment [J].Physical Experiment of College, 2012 (2): 75-77.
[5]   Zhu Shikun. Taking the construction of experimental demonstration center as an opportunity to

promote experimental teaching reform. Research and exploration of laboratory [J]. 2007,26 (4): 95-100.

[6]   Chen Xiaoping, Liu Jianqiang. Design, construction and application practice of college physics course [J]. university physics, 2016,35 (9): 3-6.

[7]   Yuan Peng, Wang Diansheng, et al. Reform and exploration of turnover course of physics courses in Colleges and universities [J]. [5] Zhu Shikun. Taking the construction of experimental demonstration center as an opportunity to promote experimental teaching reform. Research and exploration of [J]. laboratory, 2007,26 (4): 95-100.

[8]   Zhang Rui, Wang Zuyuan, et al. Study on Instructional Design of blended teaching of physics and engineering Internet plus [J]. Physics and Engineering. 2016,26 (5): 18-21.

[9]   Huo Jianqing, The guiding ideology and interpretation of basic requirements of the course of University Physics Experiment Teaching [J]. physics and engineering.2007,17 (1): 5-9.

[10] Chen Zhongjun, Yu Meisun. Reflections and suggestions on experimental teaching of College Physics [J]. experimental techniques and management,.2014,31 (4): 186-188.

[11] Yu Xi. Some misunderstanding and reform of the university physics experiment course [J]. physics experiment.2009,29 (1): 14-16.

[12] Zhang Fengqin, Lin Xiaolong, Wang Xiao. The cultivation of innovative talents in the teaching reform of college physical experiment research. 2017,36 (3): 36-39..2016,26 (5): 18-21.