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Research and Practice on Virtual Simulation Experiment Teaching System of Spatial Information and Digital Technique

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***Abstract*— In the traditional experimental mode, students must carry out the experiment at the designated time and place and the laboratory also need to constantly update the experimental equipment to meet the requirements of the development of the discipline. Virtual simulation teaching system is characterized by openness and extendibility, which makes the teachers and students do experiments at any time and place as long as they can access the virtual simulation platform on one hand. On the other hand, in the use procedure, it can quickly reproduce and provide a new virtual device. The experimenter can also add the corresponding virtual devices on the platform according to their own needs. This paper puts forward suggestions and practice on virtual simulation experiment teaching system of spatial information and digital technique, an effective supplement to the traditional experiment teaching, which solve the cooperative work of virtual simulation experiment teaching system and the existing experimental teaching system and is conducive to the building of experimental practice teaching system "To be real rather than virtual with the combination of the real and the virtual and mutual supplement".**

***Index Terms*—Virtual Simulation, Experiment Teaching System, Spatial Information and Digital Technique.**

I. INTRODUCTION

In recent years, under the new industrialization, information technology and the integration of the two strategies, education information technology and its application has been highly valued and developed. It is pointed out in the National Medium and Long Term Educational Reform and Development Plan (2011- 2020), information technology has a revolutionary effect on the development of education and must be highly valued. Based on the demand of local colleges' construction of spatial information and digital technique virtual simulation experimental teaching center, this paper is established in the teaching requirement of spatial information digital technique in the school, that is, to meet the requirement of computer science and technology, communication engineering, mechanical engineering and automation, computer science and technology, mechatronic engineering, optoelectronic information science and engineering [1]. It has constructed spatial information and digital technology virtual simulation experiment teaching system according to the hierarchical modular method and is validated. Finally, it enables students grasp the spatial information and digital technology basic theory knowledge, basic theory of software engineering, engineering software development method and enables students have the spatial information management and service ability, digital engineering design and management ability, software system design and implementation ability and ability to design, implement and operate the system in the enterprise and social environment [2].

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II. CHARACTERISTICS AND EXISTING PROBLEMS OF SPATIAL INFORMATION AND DIGITAL TECHNIQUE EXPERIMENT

The spatial information and digital technique are taught extensively in undergraduate colleges in our country, aiming to enable students master the basic theory of spatial information and digital techniques and possess the spatial information management service ability [3]. As a practical discipline, the experiment of spatial information and digital technology has the following main features and problems [4].

A. Various experimental content

Spatial information and digital technique is a very practical discipline and its content is involved with computer software technology, communication technology, synthetic study on spatial information digitization, networking, visualized and intelligentialized engineering theory and technology science. It switches various carrier of spatial information into digital carrier to support the realization of digital engineering industry by loading the network communications technology into various fields.

B. Strong experimental practicalness

According to the training plan, students can pass teacher-centered imparting teaching mode, systematic study of spatial information and the relevant theoretical knowledge of digital technique curriculum. However, the traditional static multimedia classroom teaching and fragmentation experiment practice is difficult to arouse the students' enthusiasm for learning. On the contrary, it will make students form sluggishness, resulting in the decline in thinking ability and the decline of students' thinking ability and imagination. It will appear that students will achieve good examination performance but it is difficult for them to get recognition of the employing unit due to lack of

manipulative ability in practice, resulting in low employment satisfaction rate. Conversely, students will be discontented about the school's training mode. Therefore, in the process of cultivating modern space information service talents, we must constantly increase the proportion of production practice in the teaching of spatial information and digital technique.

C. *Opening of experimental site*

The training aim of spatial information and digital technique is to cultivate the talents who can adapt to innovation and integration of the new era, and eventually can serve production practice of spatial data. It determines that the spatial information and digital technology teaching place shall not only be confined to the interior but to create more conditions to let the students out of the lab and into the natural environment and the production line and carry out more diverse experiments and production practice.

III. CONSTRUCTION OF VIRTUAL SIMULATION EXPERIMENT PLATFORM

According to the content of open experiment and practice teaching system of independent course, based on the advantages of virtual simulation experiment teaching system and experiment, ss shown in the Fig. 1, the spatial information and digital technique experiment teaching system proposed in this thesis includes basic experimental teaching and three parts in comprehensive test, among them 11 teaching modules are relatively complemented and interdependent.

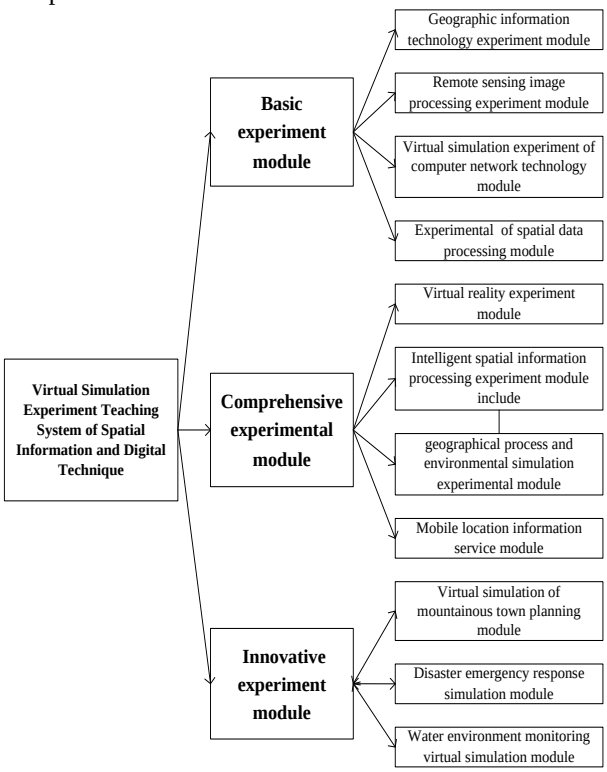

Fig. 1. The Sketch Map of the Virtual Simulation Experiment Teaching System of Spatial Information and Digital Technique

A. *Basic experiment module*

(1)Geographic information technology experiment module focuses on geographic information acquisition, storage, management, analysis and visualization expression and provides a series of experimental project, experiment project related with GIS software engineering and finally realizes the virtual simulation of each experimental project. Students can make full use of geographic information technology experiment module to carry out the experiment of geography information system and spatial information technology.

(2) Remote sensing image processing experiment module is involved with basic knowledge of remote sensing image processing, the use of basic image processing tools, text tool, path, application of layer, adjustment of picture tone and channel filter and experimental content. This experiment module can provide the learning resources for students who are interested in it through the virtual simulation experiment and support remote sensing image processing experiment teaching course for undergraduate in Information Institute meanwhile.

(3) The virtual simulation experiment module of computer network technology can help students to understand the basic technology of network communication, such as complex and abstract network protocol by constructing network communication virtual simulation teaching experiment environment. Meanwhile, it can arouse students' interest in research and dig deeper knowledge and understanding of network communication.

(4) The experimental module of spatial data processing is related to experimental projects of spatial data mining and digital mapping. It can support mapping, geo-information system, spatial information, digital technique and practical teaching of related major through the spatial data mining and the virtual simulation of the digital mapping experiment project.

B. *Comprehensive experimental module*

(1)The virtual reality experiment module includes virtual geographical environment background fabrication, spatial object 3D modeling experiment, indoor 3D scene design experiment, spatial scene rules virtual campus design and realization. This experiment aims to prepare the virtual environment which is directly related to the real spatial location and it is the foundation whether the scene effect has the sense of reality and immersion. train the students' ability to design and realize their own projects, the students should arrange the time of each stage, and grasp the progress of the project, so as to ensure the completion of the comprehensive experiment.

(2)Intelligent spatial information processing experiment module includes analysis and optimization of spatial layout, spatial statistical analysis and spatial interpolation analysis. The purpose of the experiment is to make the experimenter to understand the concept of spatial layout, optimization principles and methods, master how to use spatial analysis technology to complete the scientific planning and rational use of geographical distribution.

(3)The geographical process and environmental simulation experimental module includes the PM2.5 seasonal and regional environmental impact assessment simulation experiment and the simulation experiment of the mine environment evaluation for mine safety. The development of

the experiment can let students grasp ArcGIS usage method, spatial data storage, query method, overlay analysis procedures and process. It can let students be familiar with the layout of image output method, and method of making thematic map, allowing students to combine theory and practice and to improve the ability to solve practical engineering problems.

(4)Mobile location information service module includes spatial location analysis. Spatial location analysis is one of the basic functions of spatial analysis and can be applied widely in power station, factories and mines, school, hospital, marketplace, dwelling house, which is the typical application of space field and its influence. The purpose of the experiment is based on spatial analysis thinking, condition of design space location. Collect and deal with spatial data in line with site location, finally establish location model, calculate the spatial address space that can meet the condition, make evaluation on assemblage to provide assistant decision support for rationality of spatial location.

C. Innovative experiment module

(1)It includes three-dimensional landscape modeling, thematic inquiry, landscape modeling customization, three-dimensional space analysis and status planning and comparison and other six major function. It can help undergraduate students and postgraduate students understand the significance of urban planning, planning content and planning results and grasp the relevant technical methods of virtual mountainous town planning.

(2)Disaster emergency response simulation module will integrate casualties' model, housing collapse model and economic model into GIS platform, and collects the relevant geographic information data and socioeconomic data as the data support of modeling. According to the model simulation, rapid seismic damage assessment can not only easily divide the scope of the disaster area in the affected areas of the electronic map but also can easily calculate the disaster in different intensity circle or area ratio.

(3)Water environment monitoring virtual simulation module. Students can understand the working principle of wireless sensor networks, networking, get familiar with the use method of a variety of water quality sensors by completing the experiment in simulation software verification and optimized networking. Students can integrate the various water quality data by grasping the multi sensor data fusion algorithm, understand how to predict results of water quality change of the next period of time, and make the evaluation of water quality. They can also have time-space analysis and expression of water quality by using GIS software.

IV. CONCLUSION

Spatial information and digital technology have a wide range of applications in both traditional and emerging fields. The advantages of virtual simulation technology in the teaching of spatial information and digital technology have been fully reflected. The combination of traditional laboratory and virtual laboratory promote the in-depth integration of modern information technology and education teaching, which has not only injected new vitality into the laboratory, but also added new impetus to promote the reform of the experimental teaching and innovative talents.

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