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Virtual simulation for mechatronics engineering education

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ABSTRACT

Virtual simulation teaching is one of the important measures to achieve the integration of national new engineering and new agricultural sciences in China with advanced smart information technologies such as the artificial intelligence. This paper plans to briefly discuss about the virtual simulation for mechatronics engineering education with the support of virtual simulation core technology, starting from the integrated idea of principles and methods, system experimental design and system virtual simulation practice in the integrated experiment of mechanical and electrical systems to greatly improve the practical experience, further expand the coverage and benefits, enable students to achieve efficient and flexible virtual simulation teaching hybrid learning, improve the informatization level of the curriculum practice teaching and promoting learning efficiency. In the future, the application of virtual simulation in mechatronics engineering education will be more extensive and in-depth. It will reform and innovate the traditional experimental course practice virtual real integration teaching method, build virtual simulation teaching platform conditions, and cultivate students' innovative practical application abilities from multiple perspectives by combining the teaching knowledge points of the comprehensive experimental course of electromechanical systems and relying on key virtual simulation technology support.

KEYWORDS

Virtual simulation; Mechatronics engineering education; Intelligent measurement and control; Practical teaching

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Current Virtual Simulation in Mechatronics Engineering Education

Virtual simulation teaching is one of the important measures to achieve the integration of national new engineering and new agricultural sciences in China with advanced smart information technologies such as artificial intelligence [1-4]. Mechatronics integration technology has penetrated into various fields such as agriculture and industry as a necessary basic key technology, as well as the basic conditions for intelligent and automated facilities or equipment operation. The demand for mechatronics integration technology talents in various sectors of society has become more urgent [5-7]. Mechatronics integration technology is a comprehensive application of multidisciplinary knowledge. As a core professional basic practice for undergraduate students in emerging interdisciplinary fields such as agricultural engineering and mechanical engineering, the mechatronics engineering education integrates mechatronics integration technology and combines it with current typical industrial and agricultural mechatronics integrated systems for practical teaching. Through the comprehensive experiments of the education, students can master the theory and methods of solving various testing and control problems in mechatronics integration systems, and have the ability to analyze and solve intelligent measurement and control problems in different mechatronics integrated systems. The education has strong professionalism and practicality, and there are problems such as extensive content, complex offline practical operations, and high teaching difficulty. Therefore, how to effectively integrate virtual simulation teaching is a key link in achieving the overall practical teaching level of this education, and it is also an important means to promote students to better acquire and master comprehensive knowledge of electromechanical systems, and to organically combine it with the national new engineering, new medical, new agricultural, and new liberal arts construction in China.

Since the outbreak of the COVID-19, online learning has gradually become the norm, and people have become more and more familiar with online learning [8-10]. With the help of online learning, teachers and students can actively carry out online education and teaching without being constrained by geographical space, greatly protecting everyone's safety and facilitating learning anytime and anywhere. This greatly improves learning flexibility and also improves learning efficiency to a certain extent. However, due to the actual implementation and completion of teaching plans, most online learning methods currently focus more on simply transferring the knowledge points of offline classroom teaching to online platforms, without considering how to combine online learning with practical situations, especially for new engineering and agricultural engineering education with practical teaching content. The integration of virtual simulation teaching will effectively improve the efficiency of online teaching in practical courses.

This paper plans to briefly discuss about the virtual simulation for mechatronics engineering education with the support of virtual simulation core technology, starting from the integrated idea of principles and methods, system experimental design and system virtual simulation practice in the integrated experiment of mechanical and electrical systems. A new hybrid teaching system for the integration of virtual simulation practice in the integrated experimental course of mechanical and electrical systems will be constructed to realize the virtual simulation teaching of mechanical and electrical system comprehensive experiments

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under the integration of new engineering and new agriculture, and ultimately forming a virtual simulation teaching platform for mechanical and electrical system comprehensive experiments.

Virtual Simulation for Mechatronics Engineering Education

The virtual simulation for mechatronics engineering education could be realized by integrating and mutually verified various teaching practice research and empirical research methods and means with a focus on researching the construction of a virtual simulation teaching platform for comprehensive experiments of electromechanical systems. The virtual simulation would explore the new directions for higher education reform in China, ensure the scientificity of research work and the reliability of research conclusions. The research will be carried out according to the idea of construction and deployment of virtual simulation teaching platform, construction of virtual simulation teaching resource library, implementation verification of virtual simulation practice, improvement and optimization of virtual simulation teaching platform to provide different implementation platform conditions and path implementation methods and modes for the integration of virtual simulation and offline physical hybrid electromechanical system comprehensive experimental practice teaching in the context of new engineering and new agriculture, improve the diversity and applicability of method modes, and improve the efficiency of informationization level in higher education in China, apply research findings to educational practice and application.

The virtual simulation teaching platform for comprehensive experiments of electromechanical systems would be constructed and deployed based on the virtual simulation technology of Beijing Xiangxinli Technology Co., Ltd. and combined with the actual integrated experimental teaching, of course, mechanical and electronic measurement and automation.

Based on the virtual simulation platform and combined with the actual course, the teaching knowledge points are subdivided and constructed into virtual simulation elements, and offline physical experimental teaching is integrated to study and construct teaching resources that integrate virtual simulation, forming a course virtual simulation teaching resource library.

Integrated virtual simulation teaching resource library, based on the construction and deployment of virtual simulation teaching platform, relying on the core practical courses of undergraduate majors under the cross integration of engineering and new agricultural disciplines at China Agricultural University, virtual simulation teaching practice would be implemented. The implementation process would be summarized, selected, improved, and finally optimized systematically to form a virtual simulation practical teaching method.

Future Virtual Simulation Applications in Mechatronics Engineering Education

Under the influence of the COVID-19, the offline entity practice hybrid teaching interaction mode integrating the virtual simulation metauniverse will exist widely and for a long time. In the future, the application of virtual simulation in mechatronics engineering education will be more extensive and in-depth. It is not only necessary to implement the virtual simulation teaching reform for the curriculum, but also conducive to the immersive teaching of the curriculum practice, greatly improving the practical experience, further expanding the coverage and benefits, enabling students to achieve efficient and flexible virtual simulation teaching hybrid learning, improving the informatization level of the curriculum practice teaching and promoting learning efficiency. It will reform and innovate the traditional experimental course practice virtual real integration teaching method, build virtual simulation teaching platform conditions, and cultivate students' innovative practical application abilities from multiple perspectives by combining the teaching knowledge points of the comprehensive experimental course of electromechanical systems and relying on key virtual simulation technology support.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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