

Analysis and Research on the Mixed Reality Technology Scheme of Ship Machinery

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Abstract

Through the research of this subject, using virtual design mixed reality (MR) holographic technology, these complex ship construction processes are presented in a vivid and realistic way, so that students can easily master ship knowledge and are deeply impressed. To achieve a clear control of key knowledge points, this system allows students to intuitively understand the overall layout of the shipyard and the entire shipbuilding process. Combined with the interactivity of the system, students can be immersive Participate in the learning process of shipbuilding technology (welding, painting, assembly, etc.). Establish curriculum standards for teaching reform and guide students to participate in skill competitions.

Keywords

Marine machinery, mixed reality technology, program analysis.

1. Introduction

The shipbuilding industry is a labor-intensive, technology-intensive and capital-intensive industry. Ship products are a huge and complex system, and most of them are produced in small quantities or in single pieces. Each ship consists of thousands or even shipments. With 10,000 parts and intermediate products, the physical environment of domestic universities is expensive to construct. Physical training and teaching mainly rely on expensive experimental equipment. The initial investment is large and the later maintenance costs are high. Simple physical simulation cannot carry out human-computer interaction and cannot be constructed. Virtual experiment environment and experiment objects.

Through the research of this subject, using virtual design mixed reality (MR) holographic technology, these complex ship construction processes are presented in a vivid and realistic way, so that students can easily master ship knowledge and are deeply impressed. To achieve a clear control of key knowledge points, this system allows students to intuitively understand the overall layout of the shipyard and the entire shipbuilding process. Combined with the interactivity of the system, students can be immersive Participate in the learning process of shipbuilding technology (welding, painting, assembly, etc.). Establish curriculum standards for teaching reform and guide students to participate in skill competitions.

At the same time, it will help teachers to establish a complete system of advanced and cutting-edge vocational education that closely integrates shipbuilding and virtual simulation technology. Establish and improve the parallel model of scientific research and teaching, and consolidate and deepen basic teaching. Expand research and teaching thinking and improve teaching efficiency. It can also transform the results of related topics in the laboratory into productivity, serve the construction of the actual shipbuilding industry, and strive to create a first-class teaching subject base for higher vocational colleges in China with its own characteristics.

2. Mixed reality (MR) technology for ship professional virtual design

Virtual design mixed reality technology is a comprehensive integrated technology that has developed rapidly in recent years. It uses computers to generate a realistic three-dimensional virtual world, allowing people to experience and interact immersively as participants. It has technical advantages that cannot be matched by actual engineering. And low-cost advantages, its application has gradually expanded from aerospace, machinery manufacturing, military industry to civil fields such as bridge construction, large-scale machining and manufacturing, but applications in shipbuilding and marine engineering are still rare. However, it is precisely because the virtual reality simulation technology is interactive, conceptual and reversible, it can partially replace the physical prototype and complete the display, operation, teaching, and experience that are not allowed on the scene.

For special issues in the field of shipbuilding and marine engineering, MR/VR/AR hardware platform technology can be used to build different virtual reality hardware environments. And use virtual simulation software technology. Establish ship virtual simulation and offshore engineering platform virtual simulation platforms, and flexibly arrange and establish simulation design models through the establishment of structure and simulation model libraries. With the application of virtual simulation design technology, the overall design display, as well as the layout of equipment and pipelines can be displayed in a three-dimensional virtual reality environment; it can simulate the environment at sea; it can also simulate the process of offshore operations. Compared with the original methods, the teaching, research, learning, and training of marine engineering colleges and majors are a qualitative leap.

3. Current status at home and abroad and main problems

Domestic schools of ship and ocean engineering and virtual simulation laboratories established include: Jiangsu University of Science and Technology: Ship Advanced Manufacturing Process Simulation Laboratory (physical simulation), Harbin Engineering University: virtual shipyard simulation system, ship manipulation simulation system, structure Design experimental simulation system, ship query service system (this system completely moved a modern shipyard into computing), Huazhong University of Science and Technology: Ship and Ocean Engineering Comprehensive Experimental Teaching Base.

At present, the ship manufacturing process simulation systems of domestic universities are all scaled down physical simulations. There are tens of thousands of parts and intermediate products for each ship. The physical environment of domestic universities is expensive. Physical training and teaching mainly rely on expensive experimental equipment. The initial investment is large and the subsequent maintenance costs are high. Simple physical simulation cannot be carried out by humans and machines. Interactive, it is impossible to construct a virtual experimental environment and experimental objects, and relying on traditional textbooks and physical training teaching can no longer meet the teaching requirements under the new situation.

Under this circumstance, we adopted the subject "Research on the Application of Mixed Reality (MR) Holographic Teaching in Virtual Construction of Aircraft and Cargo Holds of Typical Bulk Carriers", and established an internationally advanced, representative, experimental teaching-based and center-of-focus to integrate ship construction with A complete system of advanced and cutting-edge vocational education closely integrated with virtual simulation technology. Establish and improve the parallel model of scientific research and teaching, and consolidate and deepen basic teaching. Expand research and teaching thinking and improve teaching efficiency. This system allows students to have a very intuitive understanding of the overall layout of the shipyard; a very intuitive understanding of the entire shipbuilding process;

combined with the interactivity of the system, students can participate in the learning process of shipbuilding technology immersively. Establishing curriculum standards for teaching reforms can better transform the results of related topics in the laboratory into productivity and serve the actual construction of the shipbuilding industry.

4. Application achievement planning

4.1. Realize the mixed reality (MR) holographic course teaching of virtual construction of typical bulk carriers

Through the virtual reality ship construction simulation training system, the realistic 3D visualization virtual display of the shipyard and facilities, the internal structure and layout of the ship, and the conventional process flow of the hull construction. Through human-computer interaction, interact with the hull model in the virtual environment to complete steel pretreatment, steel cutting, steel bending and forming, etc. At the same time, the hull assembly function provided by the system helps students understand the hull structure of the hull assembly process by simulating the actual assembly method.

4.2. Establish a virtual construction welding assembly training system for typical bulk carriers

The hull construction welding assembly training and training system needs to use more modern teaching methods to help teachers overcome the shortcomings of traditional teaching methods, so that students can learn in a more intuitive way, so as to achieve the purpose of reducing teachers' teaching load and improving students' learning effects. The main carrier of teaching methods is teaching courseware, which can include static PPT display, dynamic demonstration animation playback, virtual interactive VR roaming and other forms.

This system mainly uses computer virtual reality technology, simulation technology, intelligent control technology and interactive equipment to carry out three-dimensional exhibitions of typical bulk carrier general sections, assisting planning and design, art design, industrial design, product modeling design, virtual assembly, etc. Professional teaching and scientific research work, build an experience teaching system with real-time interactive operation of man-machines and a platform for experiment, practice, and trial training to meet the comprehensive functions of the school's teaching and scientific research industry cooperation.

4.3. Cultivate and improve the level of students' vocational skills competition

This project aims to allow students to repeatedly train the overall process and construction technology of the segmented assembly through the virtual construction of a typical bulk carrier mixed reality holographic teaching method, to understand the entire process of the real ship from scratch, so that the students can be completely in the virtual Complete the entire process of ship production, processing, and assembly in the shipyard scene, and understand each link and construction process in the block assembly process, so as to improve the students' understanding of the knowledge and skills. It is necessary to use the convenient operation mode of the PC to give students the opportunity to repeatedly train, to truly restore the appearance of the segmented assembly, and to truly master the essentials of the segmented assembly and process-related knowledge for systematic learning. A new understanding of the assessment standards of the skill competition, strict control, and practice and mastering skills without adding consumables.

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References

- [1]Ren, J., Xu, D., Xu, J. (2020). RANS Simulation for the Maneuvering and Control of a Suboff Submarine Model. *FDMP-Fluid Dynamics & Materials Processing*, 16(3), 561–572.
- [2]Ren, J., Tian, B., Xu, J. (2020). Simulation and Control of Interferometric Synthetic Aperture Sonar Towing System's Motion Behavior. *Basic & Clinical Pharmacology & Toxicology*. 20(6), 247-259.
- [3]Ren, J., Xu, J. (2020) Statistical Analysis of Principal Dimensions of Dry Bulk Carriers Navigating on Yangtze River Based on Big Data. *Transactions on Edutainment XVI. Lecture Notes in Computer Science*, vol 11782.
- [4]Ren, J., Xu, J. Zhou, H.(2019) Estimation of hydrodynamic coefficients of submarine with varying middle body length. *UPB Scientific Bulletin, Series D: Mechanical Engineering*.12(4),51-67.
- [5]Ren, J., Xu, J. (2019) .Research on improved flower pollination algorithm for multi-objective green flexible job shop scheduling. *Applied Science Issue*.25(5),145-168.