Research on the Value of Simulation Teaching of Meiyun Zhishu Digital Intelligent Factory

Shuyun Xu[1,2], Mingwei Liu[1,2], Changsheng Du[1], Yaotian Zhang[3]
1.Wuhan JSX Robot Automation Engineering Co.,Ltd, hubei wuhan, 430074
2.Wuhan Vocational College of Communications and Publishing, hubei wuhan, 430223
3.Kunming University of Science and Technology,yunnan kunming, 650504

Abstract: This paper discusses the teaching software used in the new subject of intelligent factory design and simulation in the teaching of industrial robots. By using simulation software to simulate the factory, layout stations and resources in a 3D environment, optimize and analyze interference, obtain the results of interference analysis, analyze the interference situation of interference points one by one, and establish a complete digital production line and save it for easy reuse. With the help of the simulation verification function of the simulation software, the assembly process plan can be evaluated in a virtual-real linkage manner. Through the assembly simulation function, the assembly sequence, resources and process takt time sequence can be clearly seen, so as to help enterprises make more informed manufacturing decisions. For industrial robotics, smart factory design and simulation is the virtual-real mapping and two-way interaction between the physical world and the information world. It is directly related to the design and operation of the factory, participates in the intelligent control of the factory, and also directly affects the process of factory digitization. Therefore, the simulation system used in the teaching process is extremely important. It indirectly affects the degree of students' mastery of relevant knowledge.

Key words: industrial robot; 3D digital factory; virtual-real linkage; digital twin

1. Introduction

1.1 Commonly used factory simulation system in China

Currently, the industrial robot majors in colleges and universities use industrial robot simulation software to teach and combine industrial robots, related equipment, auxiliary equipment, etc.,to form a three-dimensional virtual simulation through 1+N mode. According to the given user requirements, the production line is simulated in the simulation software, including layout design, process analysis, action rhythm and other design contents. Through functions such as simulation and simulation, it helps students to adapt to the basic capabilities and knowledge structure of enterprises in the early stage of research and development effectively improves students' ability and level and realizes the precise connection between majors and industries.

Visual components were released in 1999, and its detailed simulation of virtual assembly and ergonomics and production line assembly process, the speed of environment iteration needs to be strengthened, and the need for accurate simulation of enterprises is enhanced. Some engineering companies have started to try out the new simulation system, and the status of Visual components is likely to be optimized by other new techniques. By using a more flexible simulation system in teaching, students can master the system faster and more comprehensively to operate more quickly. In this way, it will not only make it easier for teachers to correlate corporate knowledge with teaching but also make it easier for students to understand the content of knowledge, master correlating and expanding knowledge, improve their practical ability, and expand their thinking and hands-on ability. At the same time, some factories have tried to replace the Visual components system and began to try to accept new simulation systems. To keep pace with the times and deepen the connection between schools and society, the teaching of intelligent factory design and simulation is also trying to use better software.

1.2 New teaching platform used in teaching industrial robots

The new industrial intelligent manufacturing virtual simulation system of Meiyun Zhishu industrial simulation platform MIoT.VC has a rich database and a convenient operating system, an independent discussion platform and a rich teaching video website, and it even allows students to be separated on the Internet. Learning the use of MIoT.VC has been well evaluated by the teachers of industrial robots and to apply it to the teaching of industrial robots initially. It can be well used in the learning of simulated industrial processes.

At the same time, some factories that are automated to digital are using MIoT.VC for simulation. It has powerful functions and is in line with the new simulation system in the market environment. Its use effect and convenience exceed Visual components, and it is gradually entering the vision of significant factories and related educators.

Use MIoT.VC to simulate the natural world in the virtual world, from cost savings to achieving accurate monitoring, tracking and connection, and processing process production optimization. Not only can it be used for high-speed production process industries, it can not only be verified and optimized in advance with tools but it also can be reversely analyzed based on data science modeling. Optimization. MIoT.VC can also make the factory simulation layout according to the expected production capacity, which is convenient for the analysis of the factory's logistics and transportation equipment mode and the joint research and development of equipment suppliers, the optimization of process parameters based on data science, the data presentation based on 3D factory, and the external display and development. Publicity. To meet the needs of customers and explore more markets in the future, we use various methods and data and databases of third-party systems to complete modeling, simulation interactions and applications in the MIoT.VC platform, then in the terminal MIoT.VC Between the platforms, interactive communication is carried out through the intra-site local area network.

2. Advantages of MIoT.VC Application in Industrial Robot Teaching

2.1 MIoT.VC is closely connected with industrial practice

MIoT.VC mainly focuses on the actual process production line or factory production line needs and specific applications. Considering the operation of digital factories under the epidemic situation, MIoT.VC can help enterprises to complete digital transformation services in the manufacturing field from the three dimensions of simulation, monitoring and optimization in the construction of digital factories.

MIoT.VC also has a wide range of applications in real life. Just like the chaos in the factory caused by this epidemic, its dynamic scale is unprecedented. Especially recently, cross-departmental information transfer in different places has encountered many obstacles. These include supply chain disruptions, raw material market volatility, and production instability. Fortunately, after the baptism of the epidemic, many fields have rapidly recovered in an upward spiral trend, especially the high-tech industry that regards innovation as its core competitiveness, and it has never stopped. It isn't easy to develop artificial intelligence technology. Artificial intelligence cannot be used to solve existing factory problems. If MIoT.VC is used, it can achieve the accurate expression dynamic monitoring that can be reached at present and accurately evaluate the process parameters and production conditions of new products. Introduce precise plant equipment and make a little layout; conduct virtual debugging in advance to provide an innovation incubation platform; accurately build digital models, and at the same time deepen the enterprise's understanding of physical reality. Then many virtual assemblies that can only be done due to batch copying have become within reach. Similarly, MIoT.VC lowers the threshold of data application, and people can explore new ways to optimize design and manufacturing services.

In the system digital factory, MIoT.VC can run through the business process with 3D models and realize digital manipulation of industrial processes. Through continuous data transfer, based on the 3D model, combined with system definition, simulation verification and process planning, a single data can connect all processes of the enterprise to cover digital innovation design. Digitization of the process of building a digital factory for various enterprises. Make each factory complete the construction of the digital asset platform and improve the comprehensive management ability.

MIoT.VC can build a company-level digital integrated operation management platform simulation verification platform and innovation incubation platform, From the perspective of three dimensions of simulation monitoring and optimization, MIoT.VC can build a virtual factory model corresponding to a genuine factory in the virtual world. Simulate the real world in the natural world to find out the existing problems in advance, and then save the cost, monitor the real and track the production optimization of China Unicom's processing process. It can be used for high-speed production process industries and reverse analysis based on data science modeling. The algorithm will analyze the past historical data and quality situation and optimize the first dimension of production based on the algorithm to achieve system digitization.

In the logistics rebound, enterprises will also have specific needs. First, in the standard function of ATV simulation, the application relies on full reception, and no plan will be adopted or internal verification. MIoT.VC can help The business conducts a valid objection verification. There are many cases of rapid production line in the high-tech industry. A typical simulation application requirement is product assembly and man-machine simulation. We can also perform positive and negative verification at the refined production line station level. In the assembly process of parts, the rationality of product design is verified in advance, whether it meets the technological requirements of the assembly machine, product development and process verification. Combined with the regulations related to the operating comfort of the on-site working posture personnel, this can significantly reduce errors and rework during the production line construction process, improve the quality of the production line, and at the same time, use MIoT.VC to verify the entire production logic in a virtual environment. The optimal solution and then the construction of the production line significantly save money.

2.2 MIoT.VC's powerful function

MIoT.VC has a rich library of network components and a convenient library of self-built components. It has its library of electronic components, containing over 2800 commonly used application components for factories. Most of the components in the library are parametric, and static attributes such as size, color and shape as well as dynamic attributes such as operating speed, rules and logic of the components can be modified according to layout requirements; all network component library components are provided free of charge; when the standardized application components in VC's own electronic component library cannot meet the usage requirements, a library of non-standard equipment components can be built quickly: imported 3DMAX, AutoCAD, CATIA, Pro/E, Solidworks, UG/NX, etc. 58 formats, supporting all mainstream intermediate formats such as IGES, JT, Parasolid (x_t), step/STP, etc. The model is lightweight and defines the component logic. Static attributes (such as parameter size and color) can be added quickly in a minute, and dynamic attributes (such as operation logic and motion rules) can be defined; a public cloud/private cloud/localized component library can be created as needed and accessed by project team members based on permissions; step-by-step iterations and updates are available to build an enterprise's digitization factory and knowledge base.

MIoT.VC has an open platform that is easy to operate. It can make the trinity of Products, Processes, and Plant to fully restore the production status of the factory. It can build a layout as easily as Lego blocks, quickly build a complex production line from scratch, automatically generate it with the shortest logistics route, and update itself when the component location is changed. Quickly define production and logistics operation logic, pull through all states from entering the factory to leaving, support factory-level simulation, and have robust and fast solution implementation capabilities. MIoT.VC uses a Python-based logic editor, which is easy to use without learning unpopular programming languages. Open 2000+ APIs to support in-depth, personalized development (.net)in the platform, and create an

enterprise's own simulation platform.

In virtual assembly and ergonomics, through dynamic interactive simulation and modeling in MIoT.VC, early weaknesses of the system are found,sales plans are quickly produced. VC software provides rich visualization components drag and drop components to the 3D world to complete the rapid construction of demonstration scenarios; high-performance 3D simulation engine and open APIs allow users to easily build or customize their own simulation solutions on the platform to achieve platform; quickly export line graphs, pie charts, bar graphs and other custom reports, customized output; also equipment overhead real-time display of operating parameters, 3D configuration kanban. All data in MIOT.VC can be exported to Excel tables for third-party use.

MIoT.VC supports robot simulation and offline programming, collaborative debugging of multiple brands of robots, supports exceptional robot action teaching and offline programming such as spraying and welding. MIoT.VC supports device online, and virtual debugging supports debugging of automation control logic and PLC code in a virtual environment and downloads it to the real device in combination with the teaching aids of the 1+N industrial robot system module in the training room.

MIoT.V performs physical simulation and flexible wiring harness simulation, which is not possible with Visual components. Add or disable physical simulation effects according to user needs. When the layout of the scene is too large, the physical effects can be turned off to improve the simulation speed. It supports wire harness and cable simulation, simulates the movement of cables according to the front and rear forces, and checks in real time whether it is compatible with other Dynamic interference of components.

MIoT.V can use a variety of solutions, and can export 4K high-definition pictures and animation videos up to 2160P; it supports the Blender rendering plug-in, which can perform poster-level high-level rendering; it can directly generate 2D-CAD drawings according to 3D, and embed 2D Drawing editing function; interactive VR virtual production line interaction, operating production line equipment and controlling factory operation like a game; 3D roaming and factory interaction consistent with the simulation environment can be realized through a common PDF browser without installing plug-ins; support Android , Apple and other mobile devices to roam the production line, the same 3D dynamic simulation effect as the computer. MIoT.V can realize seamless connection with Unity, high-definition rendering of 3D scene layout, and large-screen display in the factory; through communication protocols such as OPC-UA and SiemensS7-PLC, it can directly connect with mainstream brand PLC, HMI, SCADA and other equipment to realize real-time data driving. Model and factory large screen display simultaneously.

It has unique advantages in process, assembly, digital twin, process management, order scheduling, and Meiyun functions.

3. Summary

Now, all industries are rapidly changing with the new generation. It should not be only enterprises and factories that keep pace with the times. The education industry should also keep pace with the times. When the factory simulation system begins to be replaced, as relevant educators, we should be forward-looking and predict future changes to change the teaching method. Emerging simulation systems such as MIoT.V have the potential to change the market. In the future, These new systems will eventually replace simulation systems that cannot keep up with the times, and educators learning them, researching them, and using them to educate students will indeed become the mainstream trend of the future. Higher education should not be separated from life and society. It should teach students how to integrate into this society, how to survive in society, develop their abilities, be good at accepting new things, be good at using new things, and be able to get the rapid changes in this society. The necessary competencies of the student. Similarly, dual-qualified teachers should also have this ability.

In terms of the operability of MIoT.V software, this simulation system which is more convenient and practical to operate is more suitable for use in teaching, and it is the best choice to keep up with the times. Now that factories are transforming from automation to digitization and intelligence, all related industries should be changed. As far as education is concerned, the focus should be shifted from automation to intelligence. Old-fashioned people will be abandoned by the times. Only the courage to change and innovation can remain in society.

References:

[1] Song Liang. Analysis on the design and planning of the production line of the intelligent welding factory [J]. Automotive Technologist, 2021(10):58-60

[2] Liu Zhenchang. Engineering practice research based on virtual simulation factory (Factory IO) [J]. Tianjin Science and Technology, 2022, 49(04): 43-47

[3] Yao Mingshan. Simulation research on multi-AGV logistics scheduling in smart factories considering human-machine collaboration [J]. Software Guide, 2022,21(06):73-77

[4] Liu Caixia, Wang Huidong. Research and design of intelligent factory of flexible manufacturing system based on VisualOne [J]. Equipment Manufacturing Technology, 2021(11):24-27