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CONTENTS

Research on the Current Situation and Development Trends of the Collaborative R&D Tool Chain for Civil Aircraft

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Abstract: A tool chain is a set of interrelated R&D tools that perform a specific R&D task or complete a generic R&D process in accordance with a specific process.Through the development of civil aircraft collaborative R&D tool chain, the data of development tools can be effectively integrated, the research efficiency and product quality can be improved, and the process experience and knowledge in the precipitation process can be improved.By reviewing the research and development status of tool chain, this paper introduces the research and development mode of civil aircraft products based on tool chain, summarizes practical experience according to the case analysis of typical tool chain of electronic hardware, and further analyzes the challenges and development trend of the development of civil aircraft tool chain.
Keywords: aviation products; Civil aircraft development; Research and development management; R&d tool chain

1. INTRODUCTION

With the continuous development of modern aviation industry, the research and development of civil aircraft shows the characteristics of integration, complexity and interdisciplinary.Development tools play a key role in the development process, providing strong support to designers and engineers.A tool chain is a set of interrelated R&D tools that follow a specific process to perform a specific R&D task or complete a generic R&D process.Through the development of civil aircraft collaborative R&D tool chain, data of development tools can be effectively integrated, R&D efficiency and product quality can be improved, and process experience and knowledge in the process can be accumulated[1]. Therefore, civil aircraft suppliers are actively carrying out collaborative R&D tool chain research.

2. RESEARCH STATUS OF CIVIL AIRCRAFT TOOL CHAIN

In recent years, tool chain related research has increasingly become a focus in the field of complex manufacturing [2].In the field of civil aircraft, at present, most research and development units remain in the stage of research and development tool construction, and a few departments such as avionics have carried out part of the tool chain construction in advance[3], but generally lack the overall planning of the tool chain, and there are problems such as small coverage, poor practicability, and poor cross-disciplinary and cross-professional applicability.

The following is an introduction to the tool chain technology and its application status in different disciplines of civil aircraft:

System development: The tool chain of system development includes requirements analysis, system design, verification and testing tools.Modern Systems Engineering tools, such as SysML and MBSE (Model-based Systems Engineering), are used to Model and simulate various aspects of a system[4], thereby helping engineers better understand and manage the system.

Four-character design: Four-character design includes safety, reliability, maintainability and testability[5], and four-character design runs through the whole system development process. Various simulation and analysis tools are used in the toolchain to evaluate the impact of different design parameters on these four properties. These tools can reduce the need for trials and tests and accelerate product development.

Embedded software: In the civil aircraft system, embedded software is a crucial component. The toolchain for embedded software includes integrated development environments (ides)[6], version control systems, automated testing tools, and continuous integration/continuous delivery (CI/CD) tools[7] to ensure efficient and reliable software development, testing, and deployment processes.

Electronic hardware: Hardware engineers use schematics, circuit simulation, and PCB tools to design and simulate circuit boards, chips, and other hardware components. These toolchains also include electromagnetic compatibility analysis tools and temperature analysis tools to optimize hardware designs[8].

Structural design: Structural engineers use CAD and finite element analysis tools to design aircraft structures and materials. These tool chains help them analyze aspects such as stress, vibration, and fatigue to ensure the safety and performance of the structure.

Engineering Design: The engineering design tool chain can include multidisciplinary optimization tools for finding the best balance between different design

parameters. This helps reduce costs, improve performance, and shorten development cycles.

Optical design: In civil aircraft systems, optical components and sensors are very important.The Optical Design Toolchain includes optical design software and simulation tools for designing and optimizing optical systems to meet specific performance requirements.

Process design: Process engineers use CAD and CAM (Computer Aided Manufacturing) tools to plan the production process, including the assembly and manufacturing of civil aircraft systems.This helps to improve production efficiency and quality.

Engineering Management: The engineering management tool chain includes project management software, collaboration tools, and scheduling tools to track project progress, resource allocation, and team collaboration.

While toolchains play an important role in the development of civil aircraft, there are potential problems and limitations, for example, integrating various tools can lead to increased complexity, requiring more time and resources to manage and maintain the toolchain, and data consistency and interoperability issues between different tools can cause problems such as errors and delays.The overall architecture of the tool chain will cause changes in the development model, so the tool chain needs to be planned, carefully selected and effectively managed to maximize its advantages and minimize potential challenges.

3. TOOL CHAIN CIVIL AIRCRAFT PRODUCT DEVELOPMENT MODEL

The introduction of collaborative R&D tool chain will bring about changes in R&D mode.In the development of civil aircraft products, the concept of the tool chain can drive a research and development model based on systems engineering ideas, resulting in more efficient research and development, higher cost effectiveness, and better product quality.Here we discuss this research and development model.

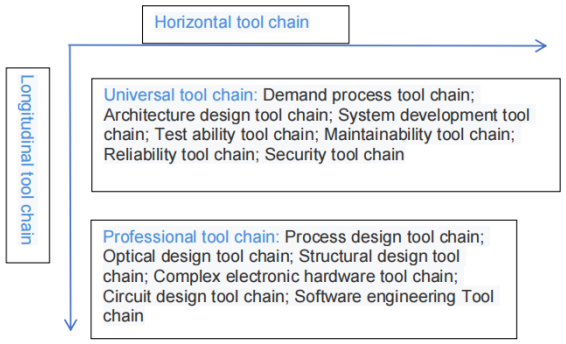

Figure 1 Overall block diagram of tool chain development mode

The overall framework of the civil aircraft collaborative R&D tool chain R&D model is shown in the figure.For example, for architecture design, the tool chain can be divided into architecture requirements configuration, functional architecture design, logical architecture design, physical architecture design, interface design and other stages in the vertical direction. Each stage corresponds to specific R&D tools and is the core of the tool chain.Horizontally, there are cross-chain calls between the tool chains. For example, for the three professional areas of requirements, architecture, and four-nature design, the requirements analysis phase needs to be carried out in parallel with the architecture configuration phase.For another example, when designing the functional architecture, it is necessary to consider the needs of the four characteristics, and then further design the logical architecture.Due to its strong professionalism, the vertical tool chain design can be clearly identified and efficiently customized based on a unified adaptation integration platform.For horizontal cross-stage call between tool chains, data processing module and automatic scheduling module need to be introduced to analyze and process the customized process, and the tool chain is divided into general tool chain and professional tool chain from a professional perspective.The universal tool chain includes the system tool chain (requirements, architecture design, system development) and the four-nature tool chain for high-level design and integration.

The whole R & D model presents the following three characteristics:

Systems engineering thought: Systems engineering thought emphasizes the comprehensiveness and synergy of the whole system.The Collaborative R&D tool chain is a powerful support for systems engineering by integrating various subject areas and treating the individual components of a product as one system to ensure they are coordinated, interoperable, and meet overall performance and requirements.

Differentiating professional applications: Collaborative R&D tool chains can be applied in different ways in different fields.For example, embedded software can use integrated development environments, version control systems, and automated testing tools to ensure that software development processes work together and automate build and test processes.Structural design can use finite element analysis tools to ensure a close synergy between structural engineering and material engineering to optimize the aircraft structure.

Integration of process activities: The collaborative R&D tool chain can help divide the R&D process into different phases and activities, enabling teams to work better together.This can include various activities such as requirements analysis, system design, hardware development, software development, testing, verification, etc.The Collaborative R&D Toolchain enables engineers in different areas of expertise to work in the same environment by integrating tools and data from different fields into a

shared platform.For example, systems engineers, structural engineers, software engineers, and optical designers can work together in the same system to share data and models.

4. CASE ANALYSIS AND PRACTICAL EXPERIENCE OF TOOL CHAIN

Collaborative research and development tool chain is of great significance in the field of electronic hardware design.The following is a case study based on Cadence design tool, simulation tool and PDM (Product Data Management) system to explore the application and effect of collaborative R&D tool chain in electronic hardware design.

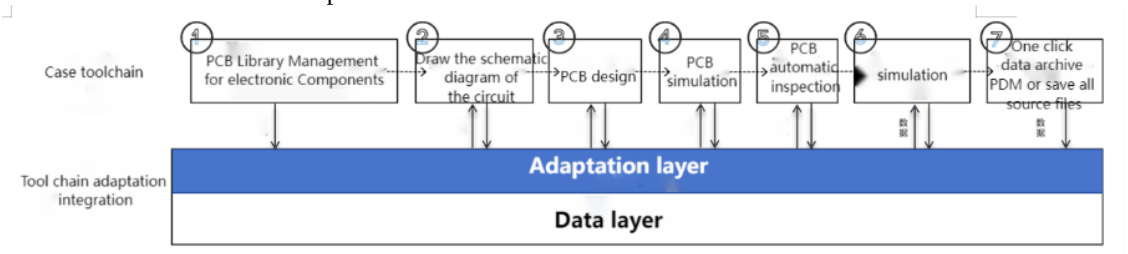

Figure 2 Case study of the electronic hardware design tool chain

4.1 Tool chain composition

Cadence tools: Include OrCAD or Allegro PCB Designer for Circuit design and PCB (Printed Circuit Board) layout.

Simulation tools: such as Cadence SPICE simulation or other simulation tools to verify the performance of the circuit.

PDM system: Used for collaborative management of design data, version control, and document management.

4.2 Case analysis

Under the unified scheduling of the adaptation integration center, the tool chain is automatically started and closed according to the preset process, and the data input and output in the process are exchanged by the design tool towards the adaptation layer.For example, the toolchain for PCB design consists of Cadence and associated simulation tools.The design data completed by Cadence enters the R & D tool adaptation integration environment through the data adapter, and is temporarily controlled by the process data control module inside. When the relevant design is completed, it enters the simulation process.The system supports the import of relevant design data required by simulation into corresponding simulation tools through the adaptation layer, so as to realize the flow of design data between different design tools and ensure the consistency and accuracy of data.

4.3 Practical experience

Circuit design Collaboration: Different team members can work together simultaneously to design circuit diagrams and PCB layouts in the Cadence tool.This ensures that design collaboration works smoothly by storing design data in the PDM system, enabling multiple people to access and edit the same design file.

Version control: The PDM system provides version control functions to ensure that different versions of the design data can be managed and tracked. This helps to avoid conflict and confusion of design data and improves the traceability of design data.

Simulation verification: Designers can use simulation tools to verify circuit performance, such as signal integrity, power distribution, etc.Simulation results can also be shared with the team for discussion and improvement.

Materials and supplier management: PDM systems can also be used to manage raw material information and supplier data to help designers select the right parts and materials.

Document management: PDM system is used to manage project documents, including design specifications, user manuals, test reports, etc.This ensures consistency and accessibility of project-related information.

4.4 Application and effects

Improved collaboration: The toolchain provides the ability for multiple people to collaborate on design, reducing information silos and barriers between different teams, and improving collaboration.

Increased efficiency: Through automation of circuit design and simulation verification, projects can progress faster, reducing design and verification cycles.

Reduce errors: The toolchain helps identify problems early, reducing the time and cost of fixing errors later.

Managing design data: PDM systems make design data management clearer and more controllable, helping teams share, collaborate, and manage project documents.

Improved project traceability: Version control and document management help project traceability to meet regulatory requirements and standards.

4.5 Key factors and precautions

Choose the right tool: Ensure that the Cadence tool and PDM system you choose meets your project needs and your team's workflow.

Train the team: Provide training for team members to fully utilize the potential of the tool chain.

Ensure data security: Protect the confidentiality and integrity of design data to prevent unauthorized access or data breaches.

4.6 Case summary

This case study highlights the practical application and effect of the collaborative R&D tool chain in electronic hardware design, bringing clear advantages in the development of civil aircraft products by integrating Cadence tools, simulation tools and PDM systems.But there are also challenges that need to be addressed, such as appropriate tool selection, training teams, data security and interoperability.However, with effective planning and implementation, the collaborative R&D tool chain is expected to become a key driver of civil aircraft product development, improving efficiency and product quality.

5. CHALLENGES AND FUTURE PROSPECTS OF TOOL CHAIN DEVELOPMENT

Based on the above analysis, the introduction of tool chain will bring two advantages in two aspects.First, collaborate to improve R&D efficiency and product quality.The key advantage of the collaborative R&D tool chain is the ability to enable collaboration between different areas of expertise.By sharing data, models, and tools, engineers in different fields can better understand the overall requirements of the system, collaborate with each other to solve problems, and reduce misunderstandings and duplication of effort.Second, the process experience and knowledge in the process of precipitation.By collaborating on the development tool chain, you can not only accelerate the development process, reduce costs, but also improve product quality.Toolchains help reduce errors and identify problems early, while also better meeting customer needs.

However, the civil aircraft collaborative R&D tool chain faces multiple challenges, including technical,

safety, management and cultural issues.We analyze these problems.

5.1 Challenges of tool chain development

5.1.1 Technical challenges:

Complexity of tool chain integration: Integrating tools from multiple different domains into a unified tool chain can be very complex, requiring sufficient technical knowledge and resources, and ensuring compatibility and smooth collaboration between tools is a challenge.

Data consistency and interoperability: Data formats, models, and standards generated by different tools may differ, and data consistency and interoperability issues need to be addressed to ensure the correct delivery and analysis of information.

5.1.2 Security challenges

Data security: In the collaborative R&D tool chain, sensitive data of civil aircraft systems may need to be shared between different teams.Therefore, data security and protection against unauthorized access become key issues.

Intellectual property protection: Collaborative toolchains can involve different organizations and vendors, requiring strict contracts and policies to ensure that intellectual property is protected and not misused or compromised.

5.1.3 Management challenges

Training and culture: Team members need to adjust to new ways of working and may need training and time to adjust to the tool chain.At the same time, the change of team culture is also a challenge.

Project Management: Effectively managing the different tools and data in the tool chain to ensure that the project is on schedule requires specialized project management skills.

5.1.4 Cultural challenges

Collaborative culture: Collaborative toolchains need to emphasize collaboration and knowledge sharing, and team members from different areas of expertise need to be willing to collaborate across domains, which may require changing the traditional culture of professional isolation.

Resistance to change: Some people may be resistant to new technologies such as tool chains, believing that traditional single-tool methods are more effective, and such problems will be gradually solved with the gradual landing and application of tool chains.

5.2 Development trend of tool chain

Looking forward to the future, combined with the development direction of civil aircraft research and development, the relevant research studies of collaborative research and development tool chain will further evolve with the introduction of new technologies, new trends and new demands, and its development trends include:

The application of artificial intelligence.Artificial intelligence, especially the emerging large language model, can be used to automate and optimize tasks in collaborative tool chains, such as data analysis, decision support, and automated design.

Virtual reality (VR)/Augmented Reality (AR).Virtual and augmented reality technologies can be used to create virtual collaborative environments that enable remote team members to work together more naturally, allowing team members to work together in a virtual world, sharing designs, simulations, and validations.

Data security.Data security will continue to be a key concern, and new technologies and standards will continue to emerge to improve data security.

Taking into account technical, safety, management and cultural challenges, the future civil aircraft collaborative R&D tool chain will continue to evolve and improve R&D efficiency, reduce costs and improve product quality through innovative technologies and closer interdisciplinary collaboration.

6. CONCLUSION

Taking the tool chain of civil aircraft research and development as the starting point, this paper summarizes the research and application status of tool chain in various fields involved in civil aircraft research and development, puts forward a civil aircraft product research and development model based on collaborative tool chain, discusses the application and effect of collaborative tool chain in electronic hardware design based on case analysis, and reveals the key role of tool chain in civil aircraft research and development.The paper also discusses the challenges facing the tool chain, including technical, security, management and cultural issues, and looks at the future trends of the tool chain, including the application of artificial intelligence, virtual/augmented reality, data security and other technologies.

Through the typical tool chain case analysis of electronic hardware, we can see the great potential of tool chain in the field of civil aircraft research and development.The tool chain's R&D model supports systems engineering ideas, which can improve R&D efficiency, product quality and reduce R&D costs, bringing greater innovation and competitiveness to the aviation manufacturing industry.It is believed that with the in-depth study of tool chain in the field of civil aircraft research and development, the development level of domestic civil aircraft industry will be a higher level!

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Diagnosis and Treatment of Mastitis in Ewes

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Abstract: Mastitis is one of the most serious diseases affecting ewes, which seriously affects the health of ewes and lambs and causes huge economic losses. This paper introduces the clinical symptoms, harm and diagnostic methods of ewe mastitis, analyzes the causes of the disease, and puts forward preventive measures and treatment methods for farmers. Fewe mastitis is a disease of the reproductive system with a higher incidence during the breeding season. Inflammatory breast lesions often cause a series of adverse reactions. Lambs can directly eat the pathogens and toxins in their milk, leading to a series of gastrointestinal and respiratory diseases, and even death. In addition, after the occurrence of ewe mastitis epidemic, seriously harm the normal lactation and normal production of breeding ewes, so that the service life of breeding ewes is greatly shortened, or even eliminated, sometimes not. Clinically, the etiology of ewe mastitis is a highly complex disease of comprehensive reproductive disorders, including physiology, pathology, feeding, nutrition and other factors. In order to better prevent and control ewe mastitis, it is necessary to effectively explore the cause of the disease and develop a comprehensive and effective prevention and control plan. Gradually avoid serious economic losses.

Keywords: ewe; mastitis; clinical symptoms; diagnostic methods; prevention and treatment

1. THE RISK OF DEVELOPING MASTITIS IN THE EWES

Mastitis, also known as breast carbuncle in Chinese medicine, is a common disease in ewe feeding. Is more harmful to the ewes and lambs. Cause the ewe's milk degeneration, can cause severe systemic symptoms, and even death.severe damage. In breeding, we should attach great importance to the disease and take scientific prevention and control measures.

The risk of mastitis in ewes varies. On the other hand, the appearance of inflammatory lesions in the breast can affect normal lactation, leading to a gradual decrease in milk production.

reduce. In addition, various pathogenic microorganisms produce a large number of toxins in the mammary gland, which greatly changes the physical and chemical properties of the milk, resulting in milk stratification and numerous clumps and clumps in the milk. If the symptoms of mastitis worsen or develop into suppurative mastitis, the affected sheep will stop lactation, directly affecting the normal feeding of the breeding ewes. Most importantly, some pathogenic microorganisms in the breast can also destroy the secretory cells of the breast and affect the secretion function, resulting in a significant decrease in the milk fat, lactose and protein content in goat's milk. This means that it is possible that in the process of dairy goat breeding management, some farms have mastitis hazards, resulting in a serious decline in the quality of goat milk, poor food safety, and the content of Escherichia coli, Staphylococcus yellow fungus, streptococcus and Streptococcus pyogenes in dairy products significantly increased bacteria. Once the unqualified dairy products are put on the market. Due to the deterioration of sheep's milk, sheep's milk contains a large number of pathogenic microorganisms, lambs eat sheep's milk will get sick. At present, a lot of farmers in the prevention and treatment of ewe mastitis process, simple antibiotic treatment. Due to the large use of a variety of antibiotics, the residue of drugs in dairy products greatly exceeds the standard, the drug resistance of many pathogenic microorganisms is significantly enhanced, and the prevention and control effect of various drugs gradually decreases. Lamb mastitis not only leads to the lamb itself weakness and even death, but also due to the decline of milk production and quality, the lamb has nutrition deficiency, malnutrition, short stature, weakness and other health conditions, reducing the commercial value of dairy products. There is also the milk produced by ewe mastitis contains a lot of Escherichia coli, Staphylococcus aureus and other pathogenic bacteria, there is a certain risk after eating.[1]

2. CLINICAL MANIFESTATIONS

Mastitis is mainly divided into acute mastitis, subacute mastitis and recessive mastitis according to the severity of the disease and its course. At the time of acute attack.[2]

With the growth of age, the breast is red and sore, the body temperature increases significantly, touch the swollen breast has obvious pain, the sick sheep will not touch. The milk in the breast is no longer discharged normally, the amount of ewes is greatly reduced, and may even stop lactation. Some sick sheep produce milk thin as water, and a small amount of pus and aggregate can be seen at the same time. Up to 42 C, food intake was significantly reduced and rumination ceased. Do not touch the breast, avoid

milking by hand or breastfeeding ewes. In addition to mammary gland enlargement, some sheep also appear keratitis and arthritis, but if the course of the disease is prolonged, mammary gland enlargement, the surface of many bulging papules, gradually suppuration, suppuration. Significant swelling around the breast, red swelling, hot pain symptoms are obvious, the lymph nodes in the breast are enlarged, the milk is thin, the secretions are not part of the blood and concentrated juice mixed, the milk production is sharply reduced or stopped. In severe cases, the milk may be a light yellow or red water pattern, and microscopic examination can reveal a large number of breast epithelial cells in the milk. The eyes are sunken and sleepy. Sick sheep are difficult to rise and lie, unwilling to lie on the ground for a long time, body temperature rises, lasting for several days, weight loss rapidly, often die of sepsis. People who have experienced the acute phase gradually transition to chronic mastitis, they will feel large and small lumps when touching the breast, breast elasticity decreases, milk production continues to decrease, and some people may even stop breastfeeding completely. In some cases, goat milk may not change significantly, but if laboratory tests indicate that goat milk contains pathogenic bacteria, the affected milk area becomes fibrotic and stops breastfeeding.

Subclinical mastitis mainly shows normal lactation, normal eating and good mental state, but the properties of milk are very different. The pH test or somatic test showed a significant decrease in pH values and a significant increase in somatic cell numbers.

3. TREATMENT

3.1 Topical treatment

There are three main types of local therapy: (1) injecting liquid solution into the breast. The method is to squeeze the milk of the sick sheep out.

Finally, inject 400,000 units and 0.5% procaine solution 5ml (penicillin in procaine solution) into the nipple through the nipple hole, and gently rub the breast to distribute the solution evenly. Mammary gland, 1-2 times daily. Studies have shown that the use of nano-silver breast injection has a certain effect on mild mastitis, and does not produce reverse milk.(2) Block therapy, such as the perineal nerve block method, and the breast base block method.① Perineal nerve blocking method: on the lower lip joint, that is, the central depression of the sciatic arch, the left thumb presses the depression, the right hand holds the needle, stabbed 1.5~ 2 cm into the perineal nerve.800,000 units and 10-20 ml of 0.5% procaine solution were injected into the affected side, and 1 ml each of penicillin and streptomycin were added to 0.25% to 0.5% procaine per leaf to improve efficacy. The stimulation point of the posterior breast lobe can be warm compress 2-3 days after the midline of the breast.[3]

3.2 Western medicine treatment

In order to reduce inflammation and reduce symptoms, penicillin 400,000 to 600,000 units and 0.5% procaine were mixed with 5 ml, injected into the sick goat breast through a milk tube, and then the goat breast was massaged. The liquid is evenly distributed. On this basis, cold and hot compress can be combined to promote the absorption and dissipation of inflammatory exudates. First cold compress, reduce the breast temperature, 3 days later hot compress, increase the breast blood circulation, promote inflammatory exudate discharge. Apply 1000 mL of 10% magnesium sulfate solution, heat to about 40-45℃, wash warm sick sheep 1-2 times a day, and use them for 4-6 consecutive times. Treatment with antibiotics is the most effective and rapid method, the commonly used are penicillin, streptomycin, gentamicin, erythromycin, amoxicillin, kanamycin, enrofloxacin and so on.[4] Use strictly follow the antibiotic instructions and do not increase the dose unnecessary. Otherwise, resistance may develop, resulting in a significant reduction in therapeutic efficacy and reducing excessive production of antibiotics in goat milk. Rational use of antibiotics can not only achieve excellent treatment effect in a short time, but also can avoid the occurrence of intractable mastitis. During the treatment, breast milk was squeezed out, 400,000 units of penicillin and 0.5g of streptomycin were dissolved in 5 mL of injection water, injected by catheter, and the breast was gently rubbed to promote the uniform distribution and absorption of the breast. liquid medicine. At the initial stage of the disease, the breast can be cold pressed, then the milk is squeezed, and 0.25%~0.5% procaine 10 mL and 400,000 units of penicillin are injected in multiple areas of breast tissue. If the breast suppurates, it should be drained first, then cleaned with 1% potassium permanganate, and then treated with streptomycin or penicillin. Antibiotics must be used in strict accordance with the instructions and should not be increased at will. The emergence of resistance leads to a significant reduction in therapeutic efficacy, even exceeding the marker of antibiotic production in goat milk. Rational use of antibiotics, not only can achieve excellent treatment effect in a short time, can avoid intractable mastitis. During the treatment, breast milk can be squeezed out, and the breast can be rubbed gently, which to promote drug penetration. Liquid with uniform distribution and absorption. At the beginning of the disease, the first cold compress breast, and then milking.[5]

3.3 Chinese prescription treatment

Traditional Chinese medicine heat clearing and swelling method

When treated with herbs combined with antibiotics, seriously ill ewes will be more effective. The principle of treatment is to clear heat and eliminate harm, reducing swelling and dispersing knots. Take 8

grams of honeysuckle, 9 grams of dandelion, 8 grams of lilac, 6 grams of forsythia, 4 grams of tangerine peel, 4 grams of green peel, 3 grams of licorice and 10-20 ml of water. One glass of alcohol was taken orally once a day for 2 to 3 consecutive days. You can also use 40 grams of this fruit, burdock, pollen, forsythia, honeysuckle 20 grams, Scutellaria baicalensis, tangerine peel, fresh gardenia, saponin, bupleurum 15 grams, licorice, grass 10 grams. Bark, angelica, qi, wort, 10 grams each, grind, boiled water, once a day, for 3 days.[6]

Another prescription: 30 grams of fried currant, 30 grams of saponins, 60 grams of Angelica, 30 grams of frankincense, 30 grams of myrrh, 50 grams of honeysuckle, 30 grams of red peony root, 30 grams of pollen, 30 grams of Hefeng, 30 grams of north Sichuan mother, 20 grams of licorice tangerine peel drugs to reduce inflammation.

4. EFFICACY JUDGMENT CRITERIA

The symptoms of chest tightness and pain disappeared, the mental state was improved, and the body temperature decreased. When lowered, the excreted milk returns to its original state, resulting in normal lactation and normal conditions. In breastfeeding, laboratory tests indicate that breast milk does free contain pathogenic microorganisms. The symptoms of chest tightness and chest pain in the sick sheep were improved significantly, and the mental state was improved. After the ewes recover, their body temperature drops to normal levels, and normal breastfeeding is effective. The symptoms are not effectively improved, but the trend of aggravation, stool milk is purulent, mixed with a large number of aggregates, tissue stratification is very clearly considered ineffective. Effective rate = cure rate + effective rate

5. SUMMARY

Fewe mastitis is due to mechanical, physical, chemical and biological virulence factors acting on the breast of ewes, causing inflammation in the nipple or breast tissue. Breast inflammation and hyperplasia can have a significant impact on lactation, resulting in reduced milk production, altered and decreased quality of goat milk quality. This disease is more common in the following areas with higher incidence during breastfeeding or during prenatal and postnatal periods. Bully mastitis is a severe disease of the reproductive system. This disease harms the healthy growth and development of ewes and lambs, leading to a large number of lambs to die from the disease. Breeding ewes have severe breeding defects, unable to normal estrus or normal use. If the farm must eliminate high-quality breeding ewes, it will increase the economic loss of the farm, and the scale of breeding can not go up. The prevention and treatment of ewe mastitis should be comprehensive, from pathogen control, reproduction management, 30 grams of Angelica, 30 grams of licorice. If ewes have exogenous cold symptoms, they can add 50 grams of fern and 50 grams of duover on the basis of the above. Sick sheep breast with hard block, add 40 grams of peach kernel, safflower 40 grams, firewood 50 grams, 30 grams, 40 grams. Take this medicine once a day, for 5-6 days.

3.4 Food-reduction therapy

In order to reduce the breast burden and promote the early resolution of inflammation, measures to temporarily reduce the lactation function, that is, reduce the amount of concentrated feeding, feed less juicy feed, limit the amount of water, and then normal feeding. We will take measures such as feeding. After the condition improved. If the body temperature rises, take oral sulfonamides or intravenous neomycin, tetracycline and other

nutrition management and other aspects, adhere to prevention, to ensure the occurrence of this disease. A management and prevention plan should be developed. It can be controlled in a short time to avoid serious economic losses.

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Simulation of Loading and Unloading Process of Industrial Robot Based on Delfoi

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Abstract: The customized HB800 special machine machine for crankshaft has a narrow space, and industrial robots are needed to realize the automatic loading and unloading of crankshaft parts in the process of automatic production line reconstruction. In order to verify the feasibility of the production line, this paper firstly realizes the 3D modeling of industrial robot, HB800 machine tool, fixture and crankshaft parts in UGNX. Then the simulation model of industrial robot and the fixture are customized in Delfoi Robotics software. Finally, the simulation of loading and unloading process of the special machine with industrial robot, fixture and parts is realized. The simulation results demonstrate the feasibility of robot loading and unloading in the narrow space of the special machine.

Keywords: Robot; Delfoi; Up and down the material; Simulation

1. PREFACE

Qingdao Desheng Manufacture Co., LTD. was founded in 1957, is an international engine crankshaft research and development, manufacturing professional enterprises. The products cover motorcycles, new energy vehicles, off-road vehicles, unmanned aerial vehicles, small manned aircraft, compressors, general machinery, agricultural machinery, construction machinery and other fields. The overall performance index of the high-tech engine crankshaft developed by the company is better than similar products.

In order to improve the quality and productive capacity of crankshaft production, Qingdao Desheng has carried out automation and informatization transformation of traditional manufacturing equipment, used a large number of automation equipment, and customized crankshaft special processing machine tools. As the most important equipment in Industry 4.0, industrial robot has been widely used in industrial production[1], Industrial robots can realize the works of grasping, feeding, unloading, clip, flipping and other manufacturing process, which can greatly save labor costs and improve production efficiency[2]. Therefore, industrial robots can be used to realize the loading and unloading and handling work, and gradually realize the automation of the crankshaft processing process. Due to the small space of the special milling machine used in crankshaft processing, the automatic positioning clamp tooling is complex, and the fixture of the robot end effector is also complex, resulting in a small working space, more narrow and complex. At the same time, there are various shelters in the space above the machine tool, which makes it impossible to determine whether the robot interferes with the surrounding objects. Therefore, before the design and transformation of the production line, it is necessary to carry out accurate simulation of the loading and unloading process of the manipulator to ensure that the manipulator can be loading and unloading in a narrow space to avoid collision with the machine tool, and the simulation technology can solve this problem well[3].

Founded in 1990, Delfoi is a pioneer and pioneer in global robot offline programming, and is a world-class expert in production simulation, production planning and execution. With Delfoi's products and services, manufacturing companies can plan, execute and manage their manufacturing and delivery processes, which will shorten time to market, accelerate delivery, shorten delivery time, reduce inventory and improve delivery accuracy. Delfoi Robotics The product is a modern simulation platform based on Visual Components, which provides the offline robot programming and simulation solutions. The solution enables enterprises to shorten product delivery times, simplify production processes, and support industry development, marketing, and industry 4.0 solutions.

In this paper, a three-dimensional model of Fanuc R1000iA/100F is established in the UGNX software environment, and then based on the Delfoi Robitcs software, the custom method of the simulation model of industrial robot, the manipulator and the plug and play method are discussed. Under the condition of importing HB 800 special follow-up milling machine, after coordinating the relative position of the machine tool and the robot, the industrial robot, tooling fixture and machine tool are integrated together to simulate the robot loading and unloading process, and discuss the feasibility of robot loading and unloading within the narrow space range of the special follow-up milling machine.

2. ESTABLISH THE SIMULATION MODEL OF THE INDUSTRIAL ROBOT

The three-dimensional model of the robot body structure is drawn in UG NX 12.0 software, and ensure that the length and link position meet the parameters given in the FANUC Robot R1000iA Organization Operation Manual as shown in Figure 1.

The drawn, 3 D model is shown in Figure 2. To facilitate the subsequent processing of the model, each linkage is an independent entity.

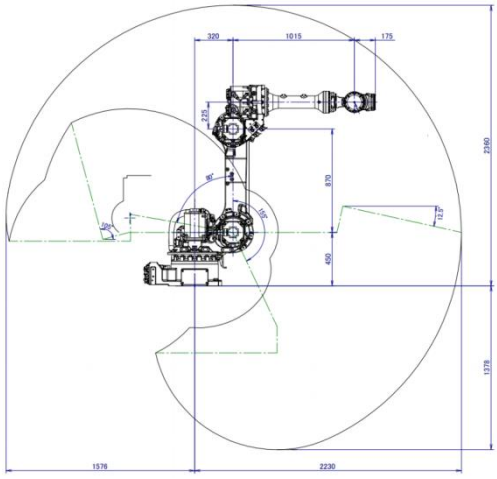

Figure 1 Fanuc R1000iA/100F action range parameters

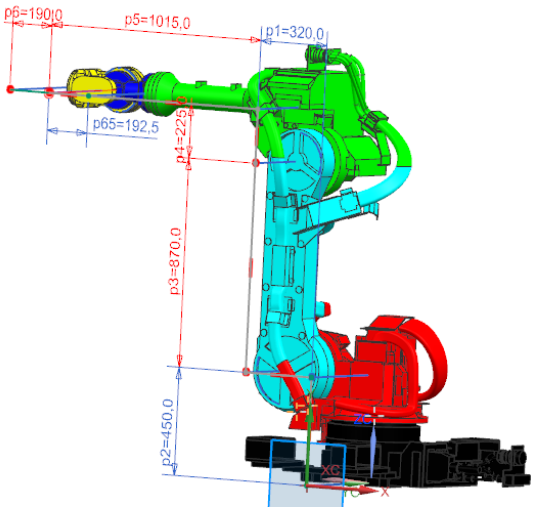

Figure 2 The Fanuc R1000iA/100F model in UGNX

Delfoi Robotics 4.2 Software, in the modeling environment. Use the Geometry function to import the Fanuc R1000iA/100F 3D model drawn in UGNX; set the feature tree option Optimization to avoid too many or too little imported geometry; Collate Geometry option collapse to simplify the set of geometric model; the upward axis option is +Z; to determine the upward axis as the positive Z axis; other defaults. Analyze the model to be imported, and make the difference between the appearance details of the robot and the number of triangular faces. On the premise of ensuring the appearance quality, the number of triangular faces is as little as possible, and generally less than 100,000.

The origin function is used to set the position of the robot to achieve the appropriate position of the robot body in the spatial X Y Z coordinates. In general, the coordinate position of the manipulator is X=0, Y=0, Y=0, Rx = 0, Ry = 0, Rz=0, the bottom plane of the robot is equal with the XY plane, the central coordinate of the bottom is zero, and the wrist direction is parallel to the + X axis.

The imported geometry is collated, and the geometry is reorganized by "collapse", "combination", "explosion", and "merge features", so that each geometry corresponds to a link of the robot body model, as shown in Figure 3.

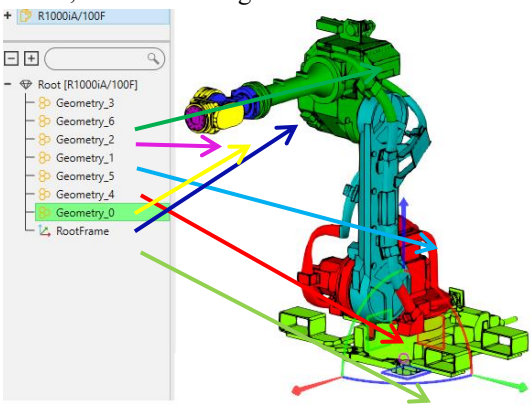

Figure 3 The geometry and corresponding linkage

From the eCatalog panel Fanuc manufacturer catalog, select an existing robot model with a similar structure to Fanuc R1000iA/100F and drag it into the 3D world, such as the ARC Mate 120i/C10L robot. You can refer to the structure of the robot and customize the new robot simulation model.

Go to the Modeling tab and select and copy the geometry of the new robot R1000iA/100F in the 3D world. Select and delete all the geometry in the template robot ARC Mate 120i/C10L. Note that only the geometry is deleted, and the template of the robot properties and behavior must be retained, because it contains the logic and behavior required by the robot simulation model. In the component diagram panel, select the root node of the template robot ARC Mate 120i/C10L and paste the geometry copied from the new robot R1000iA/100F.

Rename the geometry component to Fanuc R1000iA/100F, save it as a new component, and confirm that the option New VCID is selected.

Turn on the Show Structure option to display the motion frame of the robot. Select the "kinematics" kinematic behavior of the robot, and update the link length of the robot according to the data in Figure 1, definition, the distance between each link in the robot, the final updated results shown in Figure 4, you can see that the Kinematics each movement joint and the robot body joint together, the robot body geometry features into linkage with correct joint components.

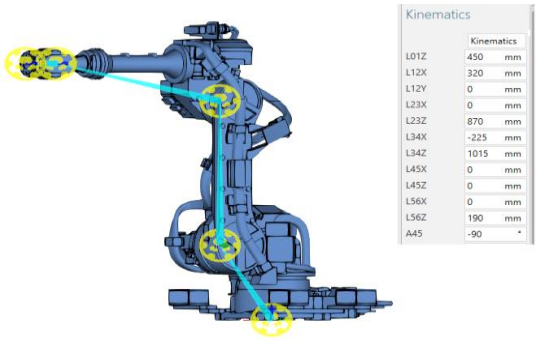

Figure 4 R1000iA/100F kinematic properties

According to the data shown in Table 1 in the FANUC Robot R-1000 iA Mechanism Operation Manual, the minimum limit, maximum limit, maximum speed, maximum acceleration and maximum deceleration value are set for each joint attribute of the J1 to J6 joints of the R1000iA/100F robot. The maximum acceleration is 4 times the maximum speed; the maximum deceleration is 4 times the maximum speed.

Table 1 R1000iA/100F Joint attributes

geometry	joint	min restrict	max restrict	max velocity	max acceleration	max deceleration
Geomatry_1	J1	-180°	180°	130°/s	520°/s^2	520°/s^2
Geomatry_2	J2	-90°	155°	110°/s	440°/s^2	440°/s^2
Geomatry_3	J3	-180°	180°	120°/s	480°/s^2	480°/s^2
Geomatry_4	J4	-360°	360°	170°/s	680°/s^2	680°/s^2
Geomatry_5	J5	-125°	125°	170°/s	680°/s^2	680°/s^2
Geomatry_6	J6	-360°	360°	250°/s	1000°/s^2	1000°/s^2

According to the corresponding relationship shown in Figure 3, drag the geometry into the corresponding joint (Geometry_1 to J1, Geometry_2 to J2, Geometry_3 to J3, Geometry_4 to J4, Geometry_5 to J5, Geometry_6 to J6). During the drag, the SHIFT key must be pressed to ensure that the geometry maintains its correct position. If the SHIFT key is not pressed, the geometry will inherit the offset of the connecting rod, resulting in the incorrect relative position.

Save the components, enter the Delfoi module, use the "point move" function to test the operation of the robot, and can simulate the operation of the robot.

3. ESTABLISH THE SIMULATION MODEL OF THE ROBOT TOOLING AND FIXTURE

At present, the jig function in industrial production, for crankshaft parts, special fixtures are designed[4]. The fixtures and workpiece installed at the end of industrial manipulator are shown in Figure 5. The jig simulation cannot be applied until it has been defined.

First, draw the fixture in the UGNX software, and assemble the parts that need to be loaded and unloaded. The fixture includes two parts: loading fixture and unloading fixture. The loading fixture is responsible for sending the blank corresponding to the process to the automatic tightening mechanism; the unloading fixture is responsible for removing the workpiece from the fixture position and placing them in the nearby transport trolley. The loading fixture and the unloading fixture have a 90 degree Angle.

After importing the fixture and workpiece model into the Delfoi Robotics, adjust the position so that the center of the round hole at the installation end is at the coordinate zero. Such shown by the following coordinate positions in Figure 5. Using the wizard, add "end effector". In the TCP option, select "Add a Tool Center Point", two coordinates can be obtained: one is TCP coordinate, adjust the coordinate to the position shown in the above point moving coordinate in figure 5 ; the other is mount frame coordinate, which is the specific installation position point. When the fixture is combined with the industrial manipulator, the fixture and the industrial robot can be moved and captured together through the "PnP" plug and play function to form a physical connection. The final results are shown in Figure 6.

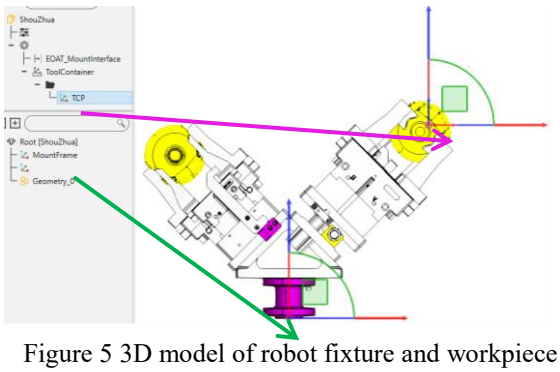

Figure 5 3D model of robot fixture and workpiece

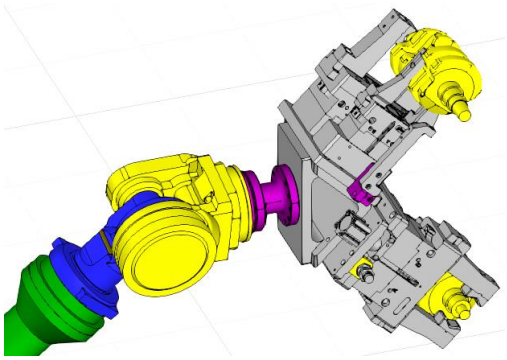

Figure 6 The robot and the tooling and fixture artifacts are installed together

4. IMPORT THE 3D MACHINE MODEL

The following machine tool is specially developed for crankshaft processing. Because it only simulates the loading and unloading process of the robot, rather than the machine tool processing process, so there is no need to define the motion mechanism of the machine tool. After drawing the 3D model of the machine in the UGNX software, it is directly imported into the Delfoi Robotics.

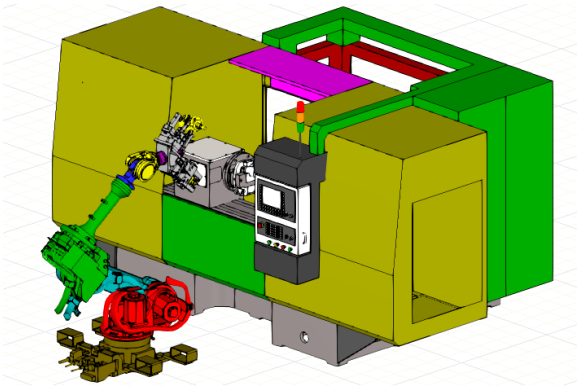

Figure 7 The simulation of robot loading and unloading process

5. VIRTUAL SIMULATION OF ROBOT FEEDING AND UNLOADING PROCESS

Under the condition of import milling machine, the Fanuc R1000iA/100F robot simulation model, the robot fixture simulation model used to drag near the milling machine position, coordinate each position, using the robot offline programming function, through the robot of the joints, realize the final robot loading and unloading simulation, as shown in figure 7. In the process of simulation, multi-angle, multi-perspective, hidden irrelevant geometry and other methods, to ensure that the feeding process does not interfere with the surrounding geometry. The simulation results can be output *. VCAX animation is sent to other employees of the company through E-Mail and other ways. It can use mobile phones, PC, tablet and other terminals to browse the simulation process of robot loading and unloading from multiple perspectives anytime and anywhere.

6. CONCLUSIONS

In Delfoi Rototics software, the process of Fanuc R1000iA/100F robot simulating the loading and unloading process of milling machine under the condition of setup fixture and workpiece.

Through the measurement function in the software, the mutual position of the robot body and the machine tool can be measured, and the off-line program can be processed and transmitted to the robot control system for further testing and fine-tuning.

On the basis of the simulation process of the working unit, the next step is to model and simulate the whole intelligent manufacturing production line, optimize the design of the production line, and evaluate the operation, production capacity and man-machine cooperation of the production line can be conducted before the construction of the production line.

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Reform of On-site Engineer Talent Training Model in Vocational Education Internships

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Abstract: Internships are a critical teaching component in vocational education, where students supplement their school education through practical experience in enterprises. However, in practice, it is common to treat students more as employees rather than learners, emphasizing their work rather than their education. This paper explores solutions to internship challenges by focusing on collaborative relationships between schools and businesses in internships, implementing a "one enterprise, one plan" strategy, emphasizing "labor education" during internships, and improving the level of information management in internship programs.

Keywords: Internship; Labor Education; Talent Training Model

1. TRANSFORMING THE COLLABORATIVE RELATIONSHIP IN INTERNSHIPS AMONG GOVERNMENT, SCHOOLS, ENTERPRISES, AND STUDENTS: REDISCOVERING THE MISSING ROLES OF THE GOVERNMENT, SCHOOLS, AND TEACHERS

Chinese educator Tao Xingzhi also stated, "Action is the beginning of knowledge, and knowledge is the culmination of action." The combination of theory and practice is most significantly manifested in vocational colleges through internships. According to the Educational Encyclopedia edited by Gu Mingyuan, an internship refers to students independently completing work tasks in production, management, service, and other positions.[1] The Ministry of Education's Several Opinions on Fully Improving the Teaching Quality of Higher Vocational Education explicitly requires the establishment of a system for enterprises to accept students from higher vocational colleges for internships, enhancing students' production internships and social practice, with the aim for students to spend at least half a year in enterprises on internships.

Internships aim to enhance students' employability and developmental potential and are set as a course for students during the professional talent training process. Since the implementation of internships, each vocational college has been actively exploring talent training models for internships. Yuan Renxi[2] proposed integrating work and study, closely linking school teaching with students' future work through school-enterprise cooperation and internships. Tang Mingming[3] and others suggested managing student internships in higher vocational colleges based on project management concepts, controlling the process and quality of internships through schedule, organization, information, quality, and safety management. Zhou Yanhua[4] and others offered strategies to solve current problems in internship management from a collaborative perspective of government, schools, enterprises, and students, providing a basis for coordinating the relationships among them. Li Junshi[5] conducted research on the quality assurance system for internships in higher vocational colleges, analyzing the establishment of an internship guarantee system, improving talent training programs, strengthening the development of in-school practical training courses, perfecting internship management systems, and establishing a diversified assessment and evaluation system. Recognizing the positive effects of internships on student training, it is also evident that there are many issues in the actual implementation of internships. Zhang Chaowei[6] and other scholars identified problems such as low relevance of internships to majors, disconnection between internships and graduation projects, and lack of practicality in graduation projects. Zhao Li[7] highlighted the phenomenon of "emphasizing employment over education"; Liu Zhongguang[8] pointed out issues like students' low enthusiasm for internships, low match between internship positions and majors, insufficient attention to internships from schools, businesses, and families, and weak links in overall guidance and supervision. Vocational colleges face both common and unique challenges in internships. Solving these challenges requires research from several aspects.

Currently, the issue with internships lies in businesses not finding ideal students, students being unwilling to participate, and schools struggling to find cooperating businesses. The root cause is the unclear relationship among government, schools, businesses, and students. When arranging internships, vocational colleges now adopt "online + offline" job fairs to attract students. Upon businesses arriving at schools, students face the businesses directly, putting students in a passive position where businesses take the initiative. The brief interactions fail to allow a deeper understanding, lacking a real reflection of the students' actual levels and the match between the offered positions and the students' skills. Once agreements are made and students enter businesses, they find mismatches with their majors, highlighting the absence of schools and

guiding teachers in this phase. After establishing platforms, schools must further guide students, especially by establishing a recommendation system. Students recommended by teachers are more easily accepted by businesses, ensuring better stability for future internships. Furthermore, once students join businesses, they receive wages based on the job requirements and leave the position upon completing their internship tasks. While this seems straightforward, the roles of schools and teachers diminish during this phase. Due to the large number of internship units and the dispersion of student internships, teachers assigned to these units cannot fulfill their duties properly. The direct outcome of internships turns into premature employment rather than continuing the students' educational tasks. The Ministry of Education and other departments jointly issued the Regulations for Vocational School Teachers' Practice in Enterprises, which mandates a minimum of six months of enterprise practice every five years based on professional characteristics. Internships should be combined with teachers' practice in enterprises, allowing both teachers and students to enter internship positions together, with teachers engaging in real practice and serving as role models for students.

Schools, businesses, and teachers should all revolve around student training. Students undergo practical training on the enterprise platform, where businesses genuinely cultivate talent to retain it. Schools play a supervisory role in the implementation of the teaching process. At the same time, the government should also play a role, providing authoritative recognition of businesses' qualifications and their ability to train students, along with policy support. Businesses that do not meet requirements should have their eligibility to accept interns revoked. Only by clarifying the responsibilities and obligations of the different roles in internships among government, schools, businesses, and students, and rediscovering the missing roles of the government, schools, and teachers, can we find solutions and strategies to address these issues.

2. EXPLORING "ONE ENTERPRISE, ONE PLAN," EMPHASIZING "LEARNING" IN THE INTEGRATION OF WORK AND STUDY

The integration of work and study, commonly adopted in internships, combines theoretical knowledge from school with practical experience at work, achieving "unity of knowledge and action." However, many vocational colleges currently adopt uniform curriculum standards when designing talent training programs for internships, not implementing "one enterprise, one plan." This results in a lack of standards to reference during the internship phase, making it impossible to assess teaching effectiveness. In developing "one enterprise, one plan" curriculum standards, schools, businesses, parents, and students should all be involved. The talent training program should further clarify that the internship is a teaching segment of the school, not disconnected from it. It should focus on "what to learn," "how to learn," and "how well to learn" in the context of work, clearly defining the student's identity during the internship, with clear learning tasks as the guide, emphasizing the acquisition of knowledge. Additionally, internships should be effectively linked with graduation projects, bringing the tasks of graduation projects to the internship positions, truly achieving joint guidance by both in-school and external teachers, with businesses needing to "value both employment and education."

3. EMPHASIZING "LABOR EDUCATION" FOR ON-SITE ENGINEER CLASS STUDENTS DURING INTERNSHIPS

Herbart once said, "I can think of no teaching that isn't educational," highlighting that teaching always possesses an educational quality. Labor education, as an essential part of the comprehensive education system that includes moral, intellectual, physical, aesthetic, and labor education, demands high attention. Liu Xiangbing[9] proposed building a labor education system for the new era in higher education through a "trinity" of labor ideology education, labor knowledge and skills cultivation, and labor practice training, integrating "active labor knowledge," "perceptual labor knowledge," and "rational labor knowledge"; promoting the transformation of university students' labor spirit, rectifying labor value orientation, and enhancing labor skill levels through professional labor education, practical labor education, curriculum labor education, and academic labor education. Wang Ying[10] and other scholars argued that strengthening labor education effectively advances the comprehensive development of education. Guo Changyi[11] pointed out in his article that labor education is a vital pathway to promote the comprehensive development of individuals, serving as an important part of quality education and laying the foundation for the comprehensive development of individuals. Wu Hejiang's[12] labor education evaluation research based on the WSR system methodology considered all factors in the physical, procedural, and human dimensions of labor education activities comprehensively and accurately grasped the relationships among these dimensions.

In the labor education training of vocational education, schools, businesses, society, families, and the students themselves all influence the teaching outcomes of labor education. Schools play a leading role in labor education, while society and businesses provide support. Families play a foundational role, and students are the subjects of labor education. The coordination among schools, businesses, society, families, and individuals, as the leading forces of labor education, is particularly important. Labor education spans the entire educational and teaching process, shifting from merely cultivating simple labor

skills to a joint cultivation by schools, society, businesses, and families, shaping students' labor spirit throughout the entire process, across all time, and through multiple channels. The lengthy period of internships provides an excellent opportunity for labor education, awakening students' thinking and cultivating their ability to think.

Schools guide students to form a Marxist view of labor, systematically learn and master necessary labor skills; businesses open practical sites, supporting schools in organizing students to participate in appropriate productive labor and new types of service labor, completing internships and technical innovation tasks; community and other social organizations conduct student life skills display activities and volunteer services; parents instill good habits of loving labor in students through daily life teaching by example, family and social ethos, and subtle influences. School labor education emphasizes cultivating students' hands-on and critical thinking skills, businesses stress the unity of knowledge and action, and social and family education focus on serving society and enhancing the value of labor.

4. ENHANCING THE INFORMATION MANAGEMENT LEVEL OF INTERNSHIPS

With the construction of informational platforms in colleges and universities, students' attendance, course selection, and management during their school years have achieved information management. However, the application of information technology in internships is relatively lagging. Many colleges have specialized internship management platforms where students can upload weekly reports, and school teachers can timely check students' internship statuses. Yet, in practice, it has been found that the internship system often prioritizes form over application, with students' weekly reports not reflecting the true feedback of their internship work, and the enthusiasm of enterprise instructors is not high. Therefore, the internship platform should be integrated with the school's teaching management platform to reduce problems caused by students constantly switching platforms. Moreover, the internship platform should monitor the entire process of students' internships, tracking students' arrival and departure during the internship process, establishing student integrity files, and avoiding safety hazards and legal disputes during the internship process.

5. EXPLORING THE INTERNSHIP TALENT TRAINING MODEL AT THE UNDERGRADUATE LEVEL IN VOCATIONAL EDUCATION

In May 2019, the Ministry of Education announced the first batch of 15 undergraduate vocational education pilot institutions, marking the beginning of a new era in China's vocational education development. Currently, 22 undergraduate-level vocational education institutions have been established in batches. The National Vocational Education Reform Implementation Plan also proposes specific construction goals and measures to comprehensively deepen vocational education reform and establish a complete modern vocational education system.[13] Vocational education reform is an urgent task in the vocational education field, and related research on undergraduate-level vocational education has become a hot topic. Wang Yanan[14] conducted a study on the development of undergraduate-level vocational education, examining its value, theoretical logic, and system construction. He proposed adhering to the type positioning during the pilot process, continuously enriching and perfecting the system of undergraduate vocational education, and guiding its institutionalized development from pilot exploration. Zong Yamei[15] and others analyzed the comprehensive reform of practical teaching in undergraduate-level vocational education, proposing a new paradigm that integrates multiple disciplines and combines learning with creative application through restructuring the practice system, reorganizing practice content, rebuilding practice carriers, and reforming teaching evaluation, thus deepening teaching reform from superficial strengthening to fundamental changes. Zang Zhijun[16] suggested that the design of the evaluation system should play a role in leveraging strengths and correcting weaknesses, establishing an output-oriented evaluation system through building an output system. At the levels of professional construction, curriculum development, and teaching implementation, an ability-based evaluation system should be established to highlight the typological characteristics of undergraduate-level vocational education. Hui Hongmei,[17] in her article on the EU vocational education evaluation system and its implications for China's vocational education, proposed that the basic principles of the indicator system construction could span pre-employment education and post-employment education, vocational education and general education, higher education and basic education, considering content indicators and guarantee indicators throughout the entire vocational education process. However, there is still relatively little exploration into internship talent training models at the undergraduate level in vocational education.

Many higher vocational colleges have begun to enroll students in undergraduate programs, and there are many apparent differences between higher vocational and undergraduate levels of vocational education, necessitating numerous adjustments to the internship talent training model. Firstly, the duration of internships will be extended; secondly, the overall ability of students, compared to higher vocational students, will be enhanced to better integrate theory with practice. How to arrange appropriate positions that correspond to school knowledge also presents a challenge in choosing cooperative enterprises.

6. CONCLUSION

This paper outlines some approaches to solving problems existing in internships within vocational education. However, the internship phase requires timely adjustments based on the current state of vocational education development and enterprise needs. Different educational levels have different strategies for internships, and each school and program has its response strategies. Therefore, the reform process of the internship talent training model is complex and variable, necessitating further research.

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Lossless Watermarking and Its Application in Medical Image Authentication

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Abstract: With the wide application of computer and information technology in the hospital health system, the digital level of hospitals has been significantly improved, and a large amount of medical data and information is generated. However, due to the importance of medical images in clinical diagnosis and legal ethics, these sensitive medical information is very easy to be intercepted when it is transmitted on the public network, and how to ensure its safe transmission is a key problem that must be solve. This paper reviews the research progress of digital watermarking technology for medical images, discusses the implementation of its application in medical images and researches the application of non-destructive watermarking technology in medical images, so as to achieve the purpose of copyright protection and authentication.

Keywords: Medical image; Watermarking; Authentication

1. INTRODUCTION

The research on watermarking technology and its application in medical images has been more fruitful. Zhang[1] first proposed a reversible information hiding algorithm in cipher text domain. In this algorithm, first the sender encrypts the image; then the operator embeds the information by flipping the three LSBs (Least Significant Bits) of the cipher text block; finally the receiver decrypts the image and extracts the embedded information. The overall embedding capacity of the algorithm is small, and there is a certain error rate of information extraction and image recovery. To address the shortcomings of Zhang's algorithm, Hong[2] proposed an improved algorithm that makes full use of inter-pixel correlation, calculates the smoothness of the image blocks by using the side-match technique, and carries out the information extraction and image restoration sequentially, which improves the correct rate of information extraction and image restoration. Zhang[3] proposed a ciphertext reversible information hiding algorithm in which the information extraction and image restoration can be separated, by which the receiver decrypts the embedded image and extracts the information through the lowest valid bit. domain reversible information hiding algorithm by compressing some of the information in the image to make space. Liu[4] proposed a ciphertext domain reversible information hiding algorithm based on redundancy transformation to transfer redundant space from the original image to the encrypted image. Based on literature [4], literature [5] improves the embedding rate and security. Literature [6] encrypts the image based on Fourier Transform and Gyrator Transform and obtains better decrypted image quality and system security. Literature [7] used block disambiguation and stream cipher encryption techniques to encrypt the image and compressed the embedded information by analysing the distribution of MSB (Maximum Significant Bit). Literature [8] encrypts the image with a special encryption method and divides the encrypted image block into smooth and complex regions according to the threshold value, and embeds the information by replacing the highest valid bit of some pixels in the smooth region and embeds the information again by using the lowest valid bit of the remaining pixels using LDPC matrix compression. Literature [9] combines

reversible information hiding algorithm with irreversible information hiding algorithm to achieve hiding more secret information with less distortion.

2. THE PRINCIPLE AND CLASSIFICATION OF DIGITAL WATERMARKING TECHNOLOGY

2.1 The principle of digital watermarking technology

The application of digital watermarking technology in medical images is based on its principle: a kind of information is embedded in the original image to achieve the purpose of image authentication, integrity verification and anti-tampering. Digital watermarking technology can be divided into two types:visible watermarking and invisible watermarking. Visible watermarking is commonly used for copyright protection and image authentication, while invisible watermarking is used for privacy protection and security authentication of medical images.

2.2 Classification of digital watermarking techniques

According to the way of digital watermarking embedding and application scenarios, digital watermarking technology can be divided into air domain watermarking and frequency domain watermarking. Null domain watermarking refers to the technology of embedding watermark information in the pixel domain of an image, and commonly used methods include modifying the lowest significant bit (LSB) and lossy compression. Frequency domain watermarking is to embed the watermark into the frequency domain of the image, and the commonly used methods are discrete cosine transform (DCT) and discrete wavelet transform (DWT).

3. RESEARCH PROGRESS OF DIGITAL WATERMARKING TECHNOLOGY FOR MEDICAL IMAGES

3.1 Authentication and Integrity Verification of Images

Digital watermarking techniques can be used for authentication and integrity verification of medical images to prevent the images from being tampered with by undesirable operations. Researchers verify the integrity and authenticity of images by embedding digital watermarks in medical images and decrypting them using the corresponding decryption algorithms. For example, researchers use LSB-based null domain watermarking technique to embed digital watermarks and then verify the integrity of the image by extracting the watermark information.

3.2 Privacy Protection and Information Security

Medical images contain a large amount of sensitive information, such as patient names and medical record numbers. The application of digital watermarking technology can achieve privacy protection and information security of medical images. By embedding invisible watermarks in medical images, researchers hide sensitive information in the images to prevent unauthorised access and tampering. In addition, digital watermarking technology can be used for the traceability of medical images to ensure the credibility of the image source.

4. APPLICATION IMPLEMENTATION OF DIGITAL WATERMARKING TECHNOLOGY FOR MEDICAL IMAGES

4.1 Embedding and extraction algorithm design

The application of medical image digital watermarking technology requires the design of corresponding embedding and extraction algorithms. The embedding algorithm is responsible for embedding the watermark information into the medical image, while the extraction algorithm is used to extract the watermark information from the image with watermark. In order to improve the robustness of the watermark, researchers often combine encryption algorithms and digital signal processing techniques to design efficient and secure algorithms.

4.2 Analysis of technical scheme

Patient CT, X-ray, MRI and other images are generated by local hospitals through medical equipment devices, which are first encrypted through scrambling and other encryption methods,

and the original medical images are turned into meaningless chaotic images. Next, the encrypted image is embedded into the public carrier image through information hiding technology. The public carrier image is stored and transmitted in the public cloud platform, and finally the original medical image is recovered lossless by extraction algorithm for remote medical consultation.Therefore, algorithms for embedding medical images into public carrier images can be designed to ensure that medical images are safely stored and transmitted in public cloud platforms, and that the original images can be extracted non-destructively at the remote consultation end so that experts can analyse and diagnose the patient through his/her consultation images, and to ensure that the patient's privacy is not compromised and that the images are stored and transmitted securely.

4.3 Algorithm Effect Evaluation and Performance Optimization

The application of medical image digital watermarking technology also requires algorithm effect evaluation and performance optimization. Algorithm effect evaluation mainly includes the visibility, robustness and anti-attack properties of the watermark, etc., and the algorithm design is optimized through the evaluation results. At the same time, performance optimization is also an important part of medical image watermarking technology, researchers can improve the operational efficiency of the algorithm and image quality by means of parallel computing, optimal coding and other means.

5 Conclusion

Medical image digital watermarking technology plays an important role in protecting image security and integrity. Starting from the principle and classification of digital watermarking technology, this paper reviews the research progress of digital watermarking technology for medical images and discusses its application implementation in medical images. With the continuous development of technology, medical image digital watermarking technology is expected to be more widely used in the future and provide better protection for the security and integrity of medical images.

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Transmission Control for Heterogeneous Fusion between Satellite Networks and Terrestrial Multi-hop Networks

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Abstract: Convergence of satellite network and terrestrial multi-hop network faces high bit error rate and long delay, which constitutes a great test for the transmission performance of the air-heaven-earth integrated network constructed by satellite network and terrestrial multi-hop network. In order to improve the heterogeneous fusion transmission performance of satellite network and terrestrial multi-hop network. In this paper, an optimization scheme is proposed to enhance the performance of the converged network by studying the transmission characteristics of the two, increasing the amount of data sent in the slow start-up phase, and distinguishing the type of data loss during congestion. Simulation verification shows that this scheme effectively reduces the node queue delay and improves the transmission efficiency, especially in the long delay environment to significantly improve the data transmission rate. This scheme significantly enhances the heterogeneous converged transmission performance of satellite networks and terrestrial multi-hop networks.

Keywords: Satellite networks; Data transmission; Multi-hop networks; Heterogeneous convergence

1. INTRODUCE

The rapid development of wireless network technology has made it increasingly in demand in special scenarios such as emergency communications after disasters, remote areas and marine environments. Satellite networks, due to their wide coverage and no need for ground infrastructure, combined with terrestrial multi-hop networks, significantly enhance the communication convenience for end customers. Terrestrial multi-hop networks do not require pre-laying of network equipment, which extends the communication range and reduces manpower and material costs.

However, the heterogeneous integration of satellite networks and terrestrial multi-hop networks in complex environments also faces many challenges. The delay and loss rate of data transmission increases, network reliability and stability decreases, and low utilization of network resources leads to network paralysis and congestion. These problems constitute a severe test for the performance and stability of wireless communication networks [1].

Aiming at these problems, this paper deeply analyses the respective characteristics of satellite networks and multi-hop networks, and this paper establishes a corresponding optimization model based on the objectives of reducing data transmission delay and increasing data transmission rate, and performs problem decomposition and designing network control strategies for the model. The research in this paper promotes the integration of the two applications in special environments. This not only helps to improve the efficiency and stability of network transmission, but also further promotes the development and application of wireless network technology.

2. RELATED WORK

A lot of research work has been carried out by researchers on satellite network transmission control. Zong [2] proposed a TCP/IP based transmission scheme for satellite network transmission performance in view of the large bandwidth delay product, high latency, high BER, etc. Nguyen [3] developed a comprehensive analytical model based on the performance of cross-layer TCP, which quantitatively shows the impact of transmission errors on the last mile link. Zong [4] proposed a cross-region, end-to-end satellite-supported multi-hop industrial Ethernet transmission control scheme that adjusts the data transmission window in two phases, slow start and congestion avoidance, to accommodate the low transmission performance due to the long latency and high error rate in the converged network. Xia [5] analyzed the existing heterogeneous network convergence architectures and explored the heterogeneous network convergence using techniques. Lubna [6] proposed a low-latency, high-data-rate (LLHD) scheduler, which successfully makes scheduling decisions on latency, path loss, and capacity based on real-time information, improving throughput and reducing data rate. Jude [7] proposed a congestion control method based on network assistance and window utilization, feedback-assisted improved recovery. Joseph [8] proposed a network-assisted and window utilization based congestion control method called feedback-assisted improved recovery with significant improvements in throughput, flow fairness and end-to-end delay performance. Jude [9] proposed a congestion avoidance mechanism based on intermediate node

queue accumulation, TCP growth based proportional rate reduction method and fast recovery mechanism.

The above research results mainly focus on the study of optimal transmission control for heterogeneous convergence of satellite and terrestrial networks, but there are fewer studies on how to improve the transmission rate, especially for remote areas where terrestrial networks are difficult to be deployed, and satellite networks are still a big challenge. In this paper, we take advantage of the low transmission rate of the satellite network, based on the information of the confirmation data and the combination of round-trip time and congestion window, which greatly improves the transmission rate of the data in the multi-hop network, and provides a reference for the transmission performance of the satellite network.

3. USABLE SCENARIO MODEL

Satellite network and terrestrial multi-hop heterogeneous convergence can provide more convenient transmission services for a variety of scenarios, especially for the occasions of the loss of basic communication facilities after a disaster, remote areas, and special environments such as the operation of the field under the mines, etc. As shown in Figure 1, the model of the satellite network and terrestrial multi-hop network in the remote areas constructed is as follows:

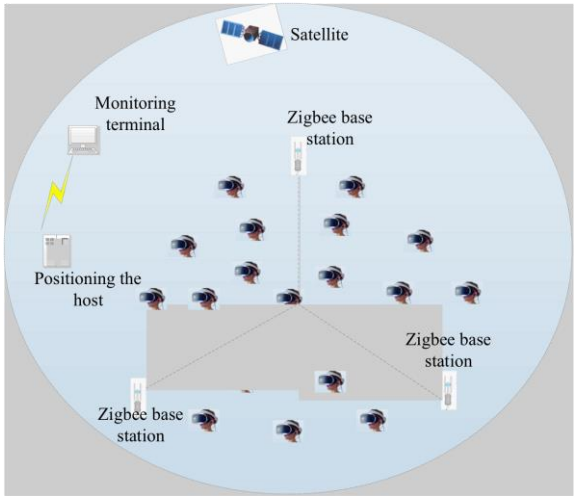

Figure 1 Applicable heterogeneous network models

The top layer in this model is the GEO satellite, which has a wide signal coverage, good anti-obscurity due to its high orbit, and its transmission link is characterized by long latency and high BER. The range of communication can be greatly expanded by multi-hop terminal, and the information collected by the base station is transmitted to the monitoring center on the ground, and the personnel can have a better and smooth contact with each other. The self-organization of multi-hop terminal can expand the communication range, and when heterogeneous with satellite network, it can further expand the communication coverage. From the above transmission path, it can be seen that this multi-hop heterogeneous fusion transmission method between satellite and ground provides diversified network access services for better data transmission between users.

4. ANALYSIS AND DISCUSSION OF RESULTS

The BER of the downlink in the satellite network is set to 1E-007 and 1E-008, respectively, and the satellite link sends data in the experiment, and the main statistics in the simulation are the results of the receiver's completion of the download response and the change of throughput in the satellite link with the BER of the satellite link. In the experiment, the multi-hop terminals are tested one by one respectively.

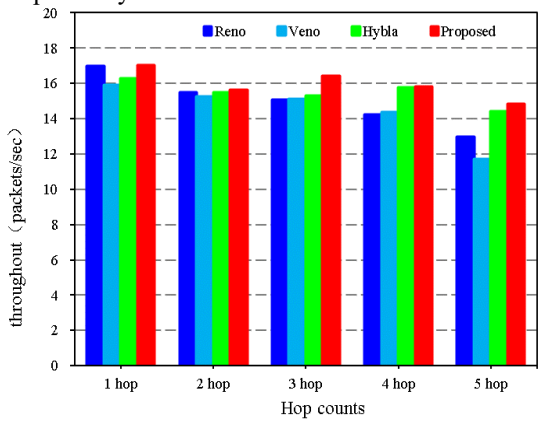

Figure 2 Transmission rate of the link at 1E-007

Figure 2 shows the transmission rate of the satellite link in a heterogeneous network with a BER of 1E-007. The transmission rate of all four algorithms is improved as the BER decreases, and the transmission rate of the proposed algorithms is generally maintained at around 16 packets/sec. As the number of hops increases, the transmission rate of all the four algorithms is decreasing.

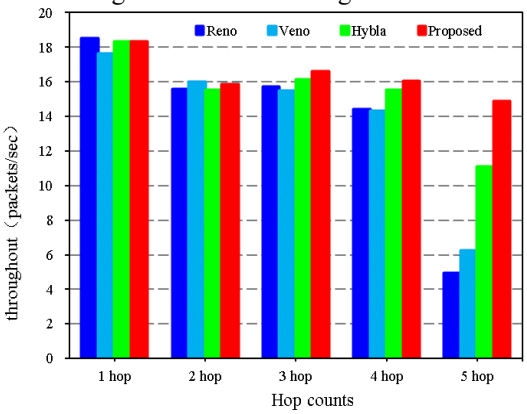

Figure 3 Transmission rate of the link at 1e-008

Figure3 When the BER is reduced to 1E-008, the transmission rate of these four algorithms is once again enhanced, and as the number of hops increases, the data transmission rate gradually decreases, and when at the 5th hop of the multi-hop terminal, the transmission rates of the other three, except for the proposed algorithm, decrease dramatically. Such data variations also verify once again that the proposed algorithm has a good stability in the transmission of

data.

5. CONCLUSION

In this paper, starting from the model building in satellite and terrestrial multi-hop networks, a combination of modeling techniques and experimental studies have been used to compare and analyze the different network protocols. The final conclusion is that the improved scheme improves the transmission rate of data in satellite networks to different degrees compared to the other three algorithms. Whether it is the change in BER or the increase and decrease in the number of hops in the multi-hop network, the new algorithm transmission rate change value is very small indicating that it has a strong stability in terms of propagation rate.

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